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Cash Transfers and Migration: Theory and Evidence from a Randomized Controlled Trial*

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Abstract

Will the fast expansion of cash-based programming in developing countries increase international migration? Theoretically, cash transfers may favor international migration by relaxing liquidity, credit, and risk constraints. But transfers, especially those conditional upon staying at home, may also increase the opportunity cost of migrating abroad. This paper evaluates the impact of a cash-for-work program on migration. Randomly selected households in Comoros were offered up to US$320 in cash in exchange for their participation in public works projects. We find that the program increased migration to Mayotte – the neighboring and richer French Island – by 38 percent, from 7.8% to 10.8%. The increase in migration is explained by the alleviation of liquidity and risk constraints, and by the fact that the program did not increase the opportunity cost of migration for likely migrants.

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1 Introduction

International migration is a defining issue of our time. The number of international migrants worldwide has grown by 57% between 2000 and 2019, from 173 million to 272 million (United Nations, 2019). More than 750 million people aspire to migrate to another country if they had the opportunity (Esipova et al., 2018). Against this background, an intense debate is raging between those portraying migrants as a threat and those arguing that the current migration policies are inhumane, unfair, or inefficient (Clemens, 2011; Baele and Sterck, 2015; Keen and Andersson, 2018). These trends are profoundly reshaping the migration and development policies of Western countries and contributing to the rise of populism in Europe and in the US (Halla et al., 2017; Mayda et al., 2018; Dustmann et al., 2018). In the wake of the "migration crises" in Europe and in the Americas, both the EU and the US introduced stricter border controls, outsourcing the deterrence of migration to third-countries (Betts, 2019; Andersson and Keen, 2019). Aid budgets were redirected towards addressing the root causes of irregular migration (Clemens and Postel, 2018) and supporting job creation in origin countries (Giambra and Mckenzie, 2019).[1]

Another transformation is concurrently reshaping development and humanitarian assistance. In view of the mounting evidence of the positive and wide-ranging effects of conditional and unconditional cash transfers (Arnold et al., 2011; Bastagli et al., 2016), cash-based programming[2] is rapidly becoming the benchmark modality of social assistance. As many as 130 low- and middle-income countries have at least one non-contributory unconditional cash transfer (UCT) program and 63 countries that have at least one conditional cash transfer program, up from two countries in 1997 (Honorati et al., 2015). Embodying this paradigm shift, the World's major humanitar-

[1]For example, in 2015, the European Commission launched the €4.6 billion EU Emergency Trust Fund for Africa to address the root causes of irregular migration and displacement in Africa, including through supporting job creation and self -employment opportunities. Similarly, since 2016, the US government has been transferring about US$700m yearly to support the Alliance for Prosperity Plan, a plan designed by El Salvador, Guatemala and Honduras to deter irregular migration and create the development conditions necessary to root their populations.

[2]Cash-based programming includes all programs of conditional and unconditional transfers of cash or vouchers, including cash-for-work programs.

ian donors and aid organizations endorsed the *Grand Bargain* at the World Humanitarian Summit in May 2016, which calls for increased use of cash-based programming to *"deliver greater choice and empowerment to affected people and strengthen local markets"*.

Do cash transfers favor or deter international migration? Understanding how positive income shocks affect international migration is critical, not only for academics working on related topics, but also for policy-makers who have preferences over migration outcomes. Theoretically, the effect of cash transfers on migration is ambiguous. On the one hand, transfers may favor international migration by relaxing liquidity, credit, and risk constraints. On the other hand, transfers, if conditional on staying at home, may increase the opportunity cost of migrating abroad. Experimental evidence is limited to the effect of Mexico's *Progresa* program on migration to the US and is somewhat conflicting. While Stecklov et al. (2005) find that the program reduced overall migration to the US, Angelucci (2015) suggests that the program increased labor-induced migration to the US by relieving the credit constraints of eligible households. Evidence from low-income countries is sorely lacking. The present study addresses the need for more robust evidence on the effects of cash transfers on international migration.

We study the impact on international migration of a randomized cash-for-work intervention targeted at very poor households in Comoros. The cash-for-work program is conceptually equivalent to a cash transfer program that is conditional upon participating in public works. Theoretically, we identify four main channels through which such cash transfer intervention could affect migration. First, cash transfers relax the budget constraint and can therefore facilitate the migration of households facing a liquidity constraint (liquidity channel). Second, cash transfers that are conditional on remaining in the origin country (e.g. to participate in public works) increase the opportunity cost of migrating and can therefore reduce migration (opportunity-cost channel). Third, cash transfers can facilitate access to credit and thereby increase migration of credit constrained households as soon as they are selected to benefit from cash transfers (credit-constraint channel). Finally, as migration is a risky investment, cash transfers can encourage the migration of individuals whose preferences are characterized by decreasing absolute risk aversion (DARA) while restraining those characterized by increasing absolute risk aversion (IARA) (risk-aversion channel).

In the empirical analysis, we assess the effects of a randomized cash-for-work program in Comoros on international migration, distinguishing the four possible channels of impact. The Comoros Social Safety Net Program (SSNP) was initiated in 2015 by the Government of Comoros and the World Bank. The main component of the SSNP provided temporary cash-for-work (CFW) opportunities to selected poor households. Between the baseline and endline surveys, beneficiary households received up to the equivalent of US$320 in cash conditional on their participation in public work activities.[3]

Migration patterns are salient in Comoros, especially towards Mayotte – the neighboring French Island. A mix of geographical proximity and economic disparities causes many Comorians to migrate to Mayotte. While Mayotte is located about 70 kilometers to the south-east of Comoros, the GDP per capita in Mayotte is 10 times that of Comoros,[4] and Mayotte has better working public infrastructures. Comorian migrants typically use small fishing boats called *kwassa-kwassa* to reach Mayotte. The journey is both risky and costly, especially since 1995, after France established visa requirements for Comorians traveling to Mayotte, hence forcing aspiring migrants to use smugglers and illegal sea routes. Thousands of Comorians have died on this often overlooked migration route. The cost of a trip is currently between US$230 and US$1150 depending on the number of migrants on the kwassa.[5]

We find that cash windfalls had a sizable and positive impact on migration to Mayotte. The migration rate of beneficiary households increased by about 38 percent, from 7.8% to 10.8%. We rule out alternative causes for the observed increase, including selective attrition and negative indirect treatment effects on control households. We find suggestive evidence that the liquidity and the risk-aversion channels drive the results.

[3]Throughout the paper, we use an exchange rate of 430 KMF (Comorian Franc) for one dollar.

[4]In 2017, the GDP per capita of Comoros in current US$ was US$1312 (World Bank data), while the GDP per capita of Mayotte was US$13,050 USD (authors' calculation based on EUROSTAT, INSEE, and OECD data).

[5]As a comparison, the median annual consumption per capita in our sample is US$460.

In the control group, migration to Mayotte is significantly larger for households with high levels of savings at baseline. In line with the liquidity channel, the effect of the cash transfers on migration to Mayotte is concentrated within households with low levels of savings at baseline. We also find that control households reporting higher degree of risk-aversion at baseline are less likely to migrate to Mayotte between survey waves. But the effect of the cash transfers on migration is concentrated within households that are more risk-averse at baseline, which suggests that cash transfers reduce risk aversion and thereby foster risky migrations.

By contrast, the opportunity cost channel seems irrelevant in this study. According to the opportunity cost channel, the impact of cash transfers on migration should be negative, which is not what we observe. The opportunity cost channel is only relevant if the cash transfer program were conditional upon the whole household staying in Comoros. In practice, the cash-for-work program was very flexible: beneficiary households were entitled to send one adult of their choice to public works. The program was not conditional upon other household members staying in Comoros. In fact, we find that migrants and workers are very different. Compared to migrants, household members who participated in the cash-for-work activities are more likely to identify as a woman, older, less educated, and less likely to have migration experience. This suggests that the program primarily increased the opportunity cost of individuals who were unlikely to migrate.

The credit-constraint channel seems negligible in our study. If this channel were operating, the effect of the cash transfer program should have appeared soon after households learned that they were selected into the program. In contrast with this prediction, we find that the effect of transfers on migration takes time to appear, in line with the liquidity channel.

Our paper makes an important contribution to the literature on the effects of cash-based programming on international migration. In a recent review, Adhikari and Gentilini (2018) identified only three empirical studies exploring the effects of cash transfer programs on international migration, all of which focus on the Mexico–US migration.

Both Stecklov et al. (2005) and Angelucci (2015) exploit random variation in the roll-out of the *Progresa* program of conditional cash transfer, but while Stecklov et al. (2005) find that *Progresa* reduced overall migration to the US, Angelucci (2015) finds that *Progresa* increased labor migration to the US. Using an instrumental variable approach, Cortina (2014) shows that the Procampo program of unconditional cash transfers increased the Mexico–US migration. A few studies also explored the effects of social assistance programs on rural–urban migration in middle-income countries. While pension programs seem to promote labor migration for young adults in recipient households (Ardington et al., 2009; Eggleston et al., 2016), India's NREGA cash-for-work program reduced short-term migration by increasing the opportunity cost of migrating (Imbert and Papp, 2019). Our study is, to our knowledge, the first to assess the effect of a social transfer program in a low-income country on international migration.

More generally, our research contributes to the literature on the determinants of international migration, adding new empirical evidence on the relationship between income and migration. Researchers using macro-level data have identified a clear inverted U-shaped relationship between income and migration rates (Dao et al., 2018; Sterck, 2019). Micro-level evidence is, however, far less conclusive, and mostly focuses on middle-income countries (Clemens et al., 2014). In line with Bazzi (2017), we find that a positive income shock affecting very poor households increases international migration by relaxing liquidity constraints. In contrast with the findings of Kaestner and Malamud (2014) and Angelucci (2015), we find no evidence of a relaxation of credit constraints.

Our paper also talks to the body of literature linking risk and migration, by showing that risk aversion may moderate the effect of cash transfers on migration. Risk is inherent to the decision to migrate. On one hand, migration is a costly investment with uncertain, but potentially large, returns (McKenzie et al., 2010; Clemens, 2011; Gibson and McKenzie, 2012; Bryan et al., 2014). On the other hand, staying home also entails some degree of risk, especially in contexts affected by political instability, insecurity, natural hazards, and poor social security. Migration can be optimal ex-ante to avoid these risks, or ex-post to cope with the negative consequences of a shock (Kleemans, 2015; Kleemans and Magruder, 2017; Mahajan and Yang, 2017). Households can also self-insure against some risks by financing the migration of one of their members (Dustmann et al., 2017; Morten, 2019), especially since migration can crowd-in risk sharing within communities (Meghir et al., 2019). Lab-experiments show that the risks associated with migration are often misestimated by potential migrants, and that risk perceptions are strongly correlated with their willingness to migrate (Bah and Batista, 2018; Batista and McKenzie, 2018). Empirical studies in a wide variety of settings conclude that risk aversion is strongly and negatively associated with mobility (Jaeger et al., 2010; Gibson and McKenzie, 2011; Akgüç et al., 2016; Goldbach and Schlüter, 2018; van Huizen and Alessie, 2019). In line with this literature, our results suggest that risk-averse households are less likely to migrate in the absence of transfers, but more likely to respond to the treatment.

Finally, our research contributes to the literature on the effects of cash-based programming. A substantial body of research documents direct positive impacts of conditional and unconditional cash transfers on nutrition, assets, education, health, and psychological wellbeing (see e.g. Arnold et al. 2011; Bastagli et al. 2016; Haushofer and Shapiro 2016; MacPherson and Sterck 2019).[6] The cash-transfer literature also identified both positive and negative externalities on non-beneficiaries through transfers or market effects (see e.g. Angelucci and De Giorgi 2009; Cunha et al. 2018; Haushofer and Shapiro 2018; D'Aoust et al. 2018; Delius and Sterck 2019). Our results suggest that migration is an additional, understudied, source of externality affecting host populations. Our paper also contributes to the literature on public-works programs, and in particular on cash-for-work programs (Gehrke and Hartwig, 2018). While observational studies identify direct positive effects of participation in public works, especially on nutrition and poverty reduction,[7] recent experimental studies offer mixed

[6]The effect of cash transfers on labor market-related outcomes depends on the context and on the conditions attached to transfers (Baird et al., 2018).

[7]See e.g. Deininger and Liu (2013) and Klonner and Oldiges (2014) on employment guarantee acts in India, Galasso and Ravallion (2004) on Argentina's Plan Jefes y Jefas, and Berhane et al. (2014) on Ethiopia's Productive Safety Nets Programme (PSNP).

evidence, with a number of studies pointing to positive short-run impacts (Christian et al., 2015; Rosas and Sabarwal, 2016) while other studies find no impact (Beegle et al., 2017; Bertrand et al., 2017). To our knowledge, our study is the first to provide experimental evidence on the effect of a cash-for-work program on migration.

The remainder of the paper is structured as follows. Section 2 develops a theoretical model of cash transfers and migration. Section 3 provides background information on migration in Comoros and on the Comoros Social Safety Net Program (SSNP). Section 4 describes the identification strategy and the data. Section 5 presents the results. Section 6 explores possible channels of impact. Section 7 concludes.

2 Theory

We propose a simple model to study how a cash transfer intervention can affect migration. We show that cash transfers can relax liquidity, credit, or risk constraints and therefore encourage migration. But cash transfers can also increase the opportunity cost of migrating if they are conditional on presence in the origin country.

We study the decision process of a household that can send one of its member abroad to work. The model has two periods, denoted t_1 and t_2. In both periods, the household first decides whether to finance the migration of one its member. If the member migrates, the household needs to pay the upfront migration costs c using savings s_{t-1} (a credit market will be added in Section 2.3). Then, the household earns an income, which is denoted w_o if all members are living in the origin country, and w_d if one member has migrated to the destination country. We assume that migration increases household income ($w_d > w_o$). Migration is therefore seen as an investment. Finally, the household decides how much of the income and savings to consume and to save for the next period. Household savings are denoted s_t ($s_t \geq 0$). Without loss of generality, we assume that the household stays if it is indifferent between staying or migrating.

We abstract from the decision to smooth consumption over time by assuming that the utility function of the household is a function of lifetime wealth ($u' > 0$, $u'' \leq 0$). Without this assumption, there is no closed-form solution when risk is included in the model.

The household has to compare three options: investing in migration in t_1 (Case 1), investing in migration in t_2 (Case 2), or not investing in migration (Case 3). The lifetime utilities associated with these cases are:

$$\begin{aligned} U^{Case1} &= u(s_0 - c + 2w_d) \\ U^{Case2} &= u(s_0 - c + w_o + w_d) \\ U^{Case3} &= u(s_0 + 2w_o) \end{aligned}$$

The following proposition characterizes the decision to finance the migration of a household member.

Proposition 1. *A household member migrates in t_1 if and only if migration can be financed in t_1 and if the benefit of migrating in t_1 is larger than the cost:*

$$\begin{cases} s_0 \geq c. & (1) \\ 2(w_d - w_o) > c & (2) \end{cases}$$

A household member migrates in t_2 if and only if migration can be financed in t_2 but not in t_1 and if the benefit of migrating in t_2 is larger than the cost:

$$\begin{cases} c - w_o \leq s_0 < c. & (3) \\ w_d - w_o > c & (4) \end{cases}$$

Proof in Appendix A.

The possible outcomes are represented in Figure 1 as a function of the wage differential $w_d - w_o$ and of initial savings s_0. In words, a member migrates in t_1 if savings are large and if the return to migration is intermediate or large. A member migrates in

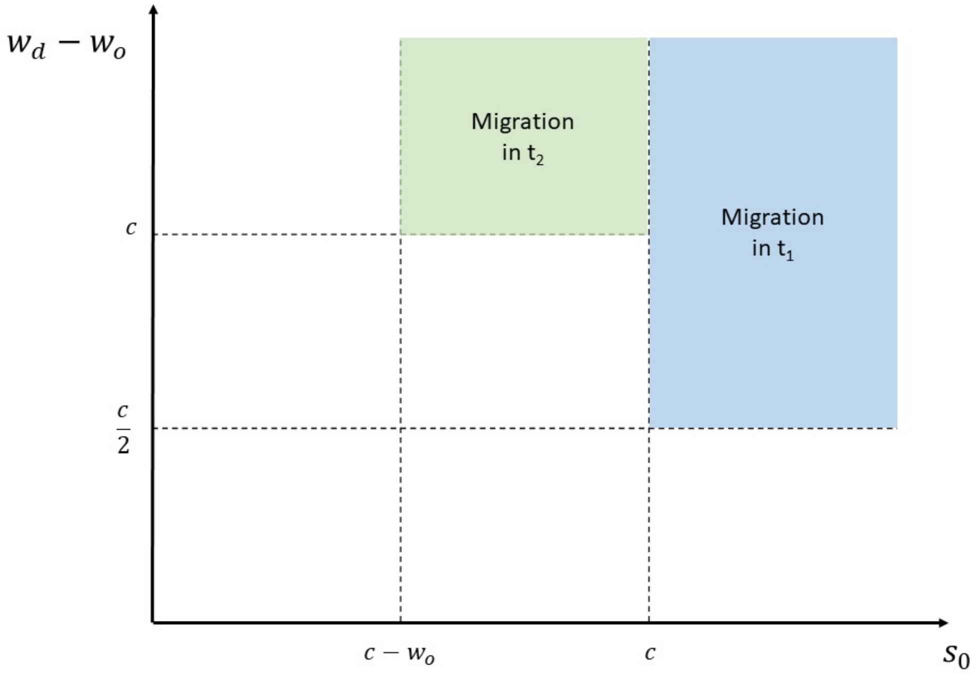


Figure 1: Outcomes of the benchmark model as a function of the wage differential $w_d - w_o$ and of initial savings s_0

t_2 if savings are intermediate and if the return to migration is large.

In the next sections, we study how a cash transfer can affect this decision-making process, distinguishing four scenarios: an unconditional cash transfer (Section 2.1), a cash transfer conditional on not migrating (Section 2.2), an unconditional cash transfer with a functioning credit market (Section 2.3), and an unconditional cash transfer in the presence of risk and risk aversion (Section 2.4).

2.1 The liquidity channel

In this first extension of the benchmark model, we assume that the household is selected to receive an unconditional cash transfer $\tau > 0$ at the end of t_1. This extra wealth can be consumed or saved. While the utility returns from migration are not affected by the cash transfer, as the cash transfer is unconditional, the budget constraint (3) is eased by the cash transfer. The cash transfer modifies the decision to migrate as follows.

Proposition 2. *While the unconditional cash transfer does not affect decision to migrate in t_1,*

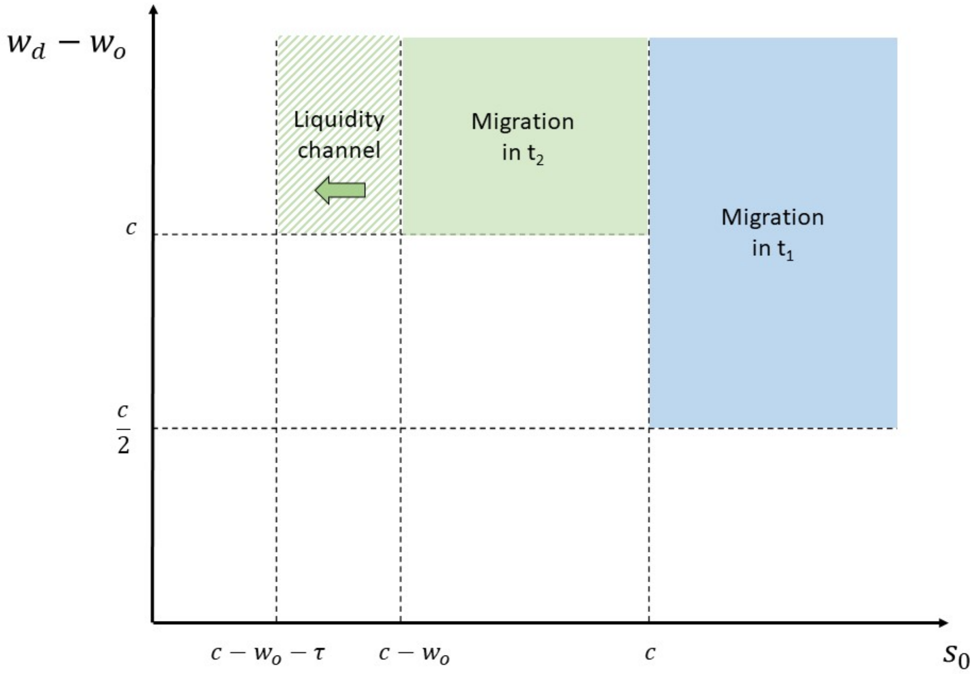


Figure 2: Effect of a cash transfer through the liquidity channel

it facilitates migration in t_2 by easing the budget constraint. In particular, a household member migrates in t_2 if:

$$\begin{cases} c - w_o - \tau \leq s_0 < c. & (5) \\ w_d - w_o > c & (6) \end{cases}$$

Proof in Appendix A.

It is clear that inequality (3) is more stringent that inequality (5): the amount τ eases the budget constraint of the household in t_2, as illustrated in Figure 2. The cash transfer allows the migration of households that would be liquidity constrained without the transfer but that are able to finance migration in t_2 thanks to the transfer.

2.2 Opportunity cost channel

We examine the effect of adding a conditionality to the cash transfer. If the cash transfer is conditional on all household members working in the origin country at t_1, households that would have been migrating in t_1 without the conditionality cancel or postpone migration if the value of the cash transfer is larger than the cost of canceling or delaying migration. Compared to the benchmark model, the conditional cash transfer does not affect the lifetime utility of migrating in t_1, but it increases the lifetime utility of migrating in t_2 and the lifetime utility of not migrating at all.

The following proposition describes when the household finances the migration of one of its member in the presence of a conditional cash transfer.

Proposition 3. *In the presence of a conditional cash transfer, a household member migrates in* t_1 *if and only if:*

$$\begin{cases} s_0 > c. & (7) \\ w_d - w_o > Max(\frac{c+\tau}{2}, \tau) & (8) \end{cases}$$

A household member migrates in t_2 *if conditions* (5) *and* (6) *are satisfied, or if:*

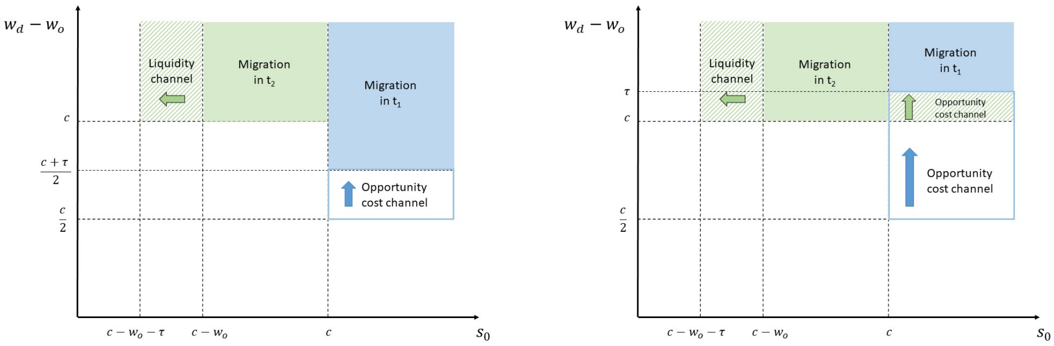
$$\begin{cases} s_0 > c. & (9) \\ c < (w_d - w_o) < \tau & (10) \end{cases}$$

Proof in Appendix A.

The effect of the conditional cash transfer is illustrated in Figures 3(a) and 3(b). On the one hand, the cash transfer increases households' ability to finance migration in t_2 (liquidity effect). On the other hand, the conditionality increases the opportunity cost of migrating in t_1. It affects the decision of households able to finance migration at t_1 ($s_0 > c$) and for which the wage differential $w_d - w_o$ is lower than the transfer τ. These households are either prevented from migrating (if the wage differential is low such that migration in t_2 is not optimal) or they postpone migration until t_2 (if the wage differential is larger than the upfront cost of migration).

2.3 Credit constraint channel

So far, we have assumed that credit markets are absent. The presence of an effective credit market would ease the budget constraint of households, who can borrow to finance migration in t_1 and pay back the loan in t_2 thanks to the wage differential



(a) Small cash transfer $\tau < c$ (b) Large cash transfer $\tau > c$

Figure 3: Effect of a conditionality

$w_d - w_o$. We assume that households can borrow a maximum amount $B \geq 0$ at the beginning of t_1. The loan needs to be repaid at the end of t_2 with an interest rate r.

In the presence of such credit market (and in the absence of cash transfer), a liquidity-constrained household borrows in t_1 to finance the migration of one of its member in t_1 if the following conditions are jointly satisfied.

Proposition 4. *The household borrow to finance migration in t_1 if:*

$$\begin{cases} c - B \leq s_0 < c. & (11) \\ w_d - w_o > Max(r(c - s_0), \dfrac{c + r(c - s_0)}{2}) & (12) \end{cases}$$

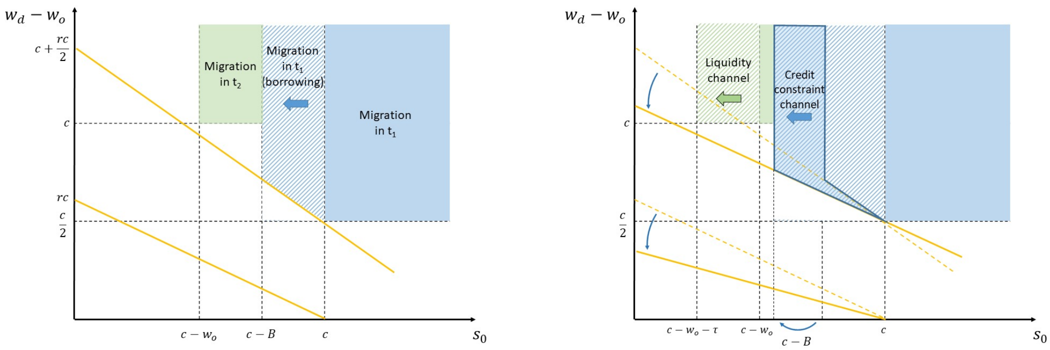
Proof in Appendix A.

Thanks to the credit market, a household facing a liquidity constraint in t_1 can finance migration through borrowing if the maximum amount of the loan B and initial savings s_0 are large enough to cover the upfront cost of migration c (Figure 4(a)).[8] However, because borrowing is costly, inequality (12), which is represented by the yellow lines on Figure 4(a), is more stringent that inequality (6).

With a functioning credit market, an unconditional cash transfer has three effects on the decision to finance migration, as illustrated in Figure 4(b). In line with the liquid-

[8] In Figure 4(a), we assume that $B < w_o$. It is indeed very unlikely that a lender would provide loans that are larger than the net present value of future income in the origin country, $\frac{w_o}{1+r}$. Results are qualitatively similar if $B \geq w_o$: instead of self-financing migration in t_2, households with $c - B \leq s_0 < c$ borrow to finance migration in t_1.

ity channel described in Section 2.1, the direct effect of an unconditional cash transfer is to ease the budget constraint in t_2, which facilitates migration in t_2 for households with intermediate levels of savings ($c - w_o - \tau \leq s_o \leq c - w_o$). But in the presence of a functioning credit market, a cash transfer can have two other indirect effects. First, the maximum amount that households can borrow, B, is likely to increase as soon as households are selected to benefit from the unconditional cash transfer, as the guaranteed future income stream can play the role of a collateral. If cash transfers are administered by a micro-credit organization, B is also likely to increase as a consequence of the greater proximity between beneficiaries and the micro-credit organization. If the maximum amount of the loan, B, is increased, more households are able to finance migration in t_1 through borrowing. Second, the interest rate of the loan r is likely to be reduced because the risk of default is reduced by the increase in future income. If the interest rate r is reduced, more households find it optimal to borrow to finance migration in t_1.



(a) Without cash transfer (b) With a cash transfer τ

Figure 4: Decision to finance migration using credit

2.4 Risk-aversion channel

In this section, we modify the benchmark model and assume that migration is risky. With a probability $p \in]0, 1[$, the migrant reaches its destination and the household income is w_d. With a probability $1 - p$, the migrant's journey is unsuccessful, and the household income is w_o. In the presence of risk, the degree of risk aversion of the household will influence the decision-making process. Risk aversion means that the utility function is concave ($u'' < 0$), which implies that households dislike zero-mean risks.

We introduce risk aversion in the model using the concepts of certainty equivalent and risk premium (Eeckhoudt et al., 2005; Myerson, 2005). The certainty equivalent of a gamble for a decision-maker is the sure amount of money that the decision-maker would be willing to accept instead of the gamble. The difference between the expected monetary value of the gamble and the certainty equivalent of the gamble is called the risk premium.[9] In the presence of risk and risk aversion, the household finances the migration attempt of one of its members if the following conditions are satisfied.

Proposition 5. *If migration is risky, a household member attempts to migrate in t_1 if:*

$$\begin{cases} s_0 > c. & (13) \\ 2p(w_d - w_o) > c + \pi_1 & (14) \end{cases}$$

where π_1 is the risk premium associated with financing migration in t_1.[10]

A household member attempts to migrate in t_2 if:

$$\begin{cases} c - w_o < s_0 < c. & (15) \\ p(w_d - w_o) > c + \pi_2 & (16) \end{cases}$$

where π_2 is the risk premium associated with financing migration in t_2.[11]

Proof in Appendix A.

The presence of risk has two effects, which are illustrated in Figure 5(a). First, risk reduces the expected benefit from migration by a factor p. Second, risk aversion

[9]For a small risk, the risk premium π can be approximated as: $\pi \approx 1/2\sigma^2 A(w)$ where σ is the variance of the gamble, and $A(w) = -u''/u'$ is the degree of absolute risk aversion of the decision-maker, which is a function of wealth w. For a large risk, the risk premium also depends upon the other moments of the distribution of the risk, not just its mean and variance.

[10]The risk premium π_1 is defined as: $u(s_o - c + 2pw_d + 2(1-p)w_o - \pi_1) = p[u(s_0 - c + 2w_d)] + (1 - p)[u(s_0 - c + 2w_o)]$.

[11]The risk premium π_2 is defined as: $u(s_o - c + w_o + pw_d + (1-p)w_o - \pi_2) = p[u(s_0 - c + w_o + w_d)] + (1-p)[u(s_0 - c + 2w_o)]$.

reduces households' expected utility of migrating, as captured by the risk premiums π_1 and π_2.

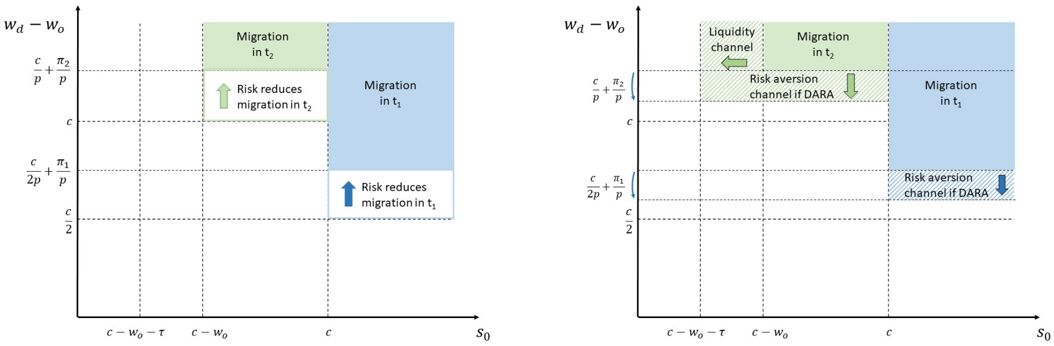
In the presence of risk and risk aversion, a cash transfer not only impacts the budget constraint (liquidity channel), but also the expected utility returns from migration. The cash transfer is an income shock. Therefore, the direction of the impact depends on how risk aversion varies with income, as summarized in the following proposition.

Proposition 6. *An unconditional cash transfer eases the budget constraint in t_2 (liquidity channel). Furthermore, if the utility function of the household is characterized by decreasing absolute risk aversion (DARA), the unconditional cash transfer increases the expected utility returns from investing in migration. By contrast, if the utility function is characterized by increasing absolute risk aversion (IARA), the unconditional cash transfer reduces the expected utility returns from investing in migration.*

Proof in Appendix A.

Experimental and empirical evidence supports the hypothesis of decreasing absolute risk aversion.[12] In Figure 5(b), we illustrate the effect of the cash transfer when the utility function is DARA. The direct effect of the transfer is to ease the budget constraint of the household in t_2 (liquidity channel). But if migration is risky and if the utility function is DARA, the cash transfer also reduces risk aversion, thereby increasing the expected utility returns from financing migration in t_1 or in t_2.

[12] See e.g. Dohmen et al. (2011), Dohmen et al. (2010), Yesuf and Bluffstone (2009), Guiso and Paiella (2008), Wik et al. (2004), and Levy (1994).



(a) Effect of risk on the decision to migrate (b) Effect of an unconditional cash transfer with DARA

Figure 5: Decision to migrate if migration is risky

3 Background of the cash-for-work program

3.1 Context

The Comoro archipelago consists of four islands located in the Mozambique Channel, between Mozambique and Madagascar (see Figure 6). Three islands belong to the Union of Comoros (Comoros henceforth), a poor country with a population of 820,000 people. The remaining island, Mayotte, is French. Mayotte is situated about 70 kilometers to the south-east of Comoros. Mayotte has a population of 260,000 people. The GDP per capita in Mayotte is more than 10 times that of Comoros.

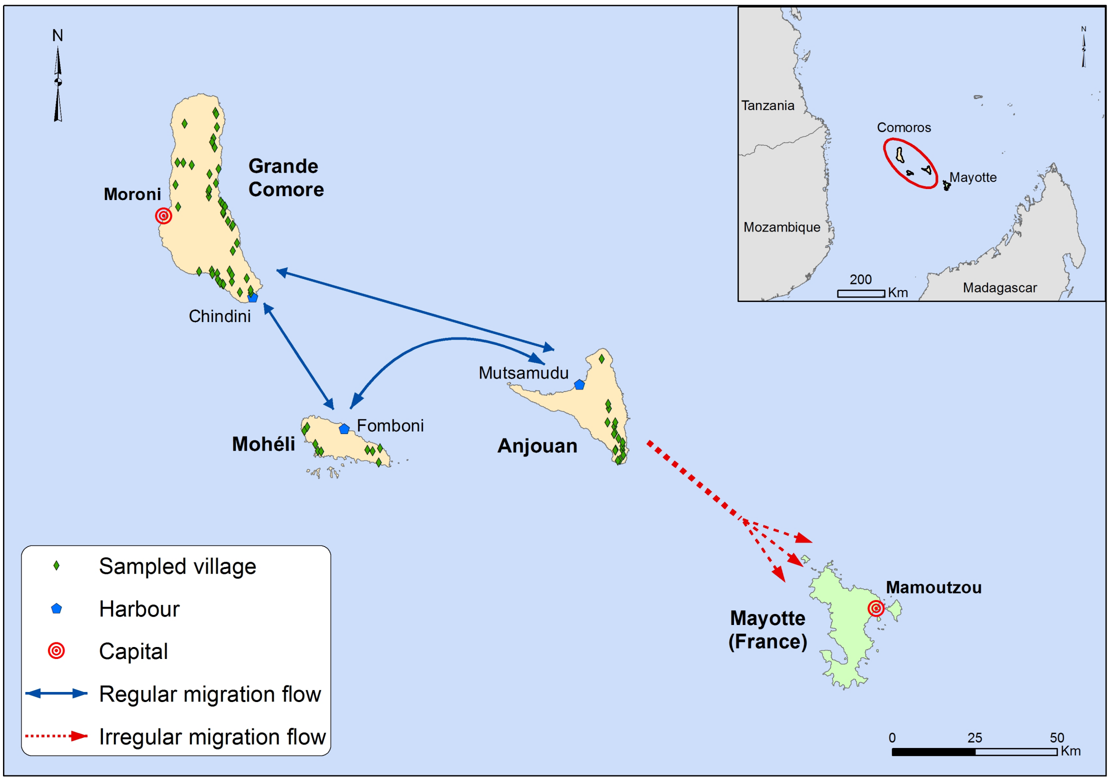
Strong ties unite the four islands. During the French colonisation, the islands were unified under a single administration and placed under the authority of the French colonial governor of Madagascar. People share a similar language, *Shikomori*, and are predominantly Muslim.[13] They also have similar social structures such as a matrilineal system shaped by the informal institution of the *Grand mariage* – a determinant of social status whose completion greatly increases one's standing in society.

However, during the 1974 independence referendum, Mayotte voted to remain politically a part of France while other islands voted for independence and formed the Comoros nation.[14] Since then, Mayotte has been continuously administered by France

[13]Slightly different variants of *Shikomori* are found on each of the four islands (*Shingazidja*, *Shimwali*, *Shinzwani* and *Shimaore*) but people can easily communicate.

[14]See Blanchy (2002) for a discussion on why the people of Mayotte decided to remain French.

Figure 6: Migration route to Mayotte



Source: Authors' elaboration

and even became a French overseas department in 2011.[15] Socioeconomic conditions have steadily improved in Mayotte while stagnating in neighboring Comorian islands. Since independence, Comoros has experienced recurring political crises and conflict between the islands. Comoros's low GDP per capita (US$1,312 in 2017) is stagnating because of relatively low GDP growth rates (between 2 and 3.5 percent) and high population growth (2.4 percent). Poverty is high with 42 percent of the population living with incomes below US$1.90 per day, and one-third of all children under five years of age suffering from chronic malnutrition. Although Mayotte is the poorest French department, its US$13,050 GDP per capita in 2017 is extremely attractive relative to Comorian standards.

In order to control the migration of Comorians to Mayotte, France issued strict visa requirements in 1995. However, illegal sea routes and human smuggling emerged such that the flow of Comorian migrants never stopped to date. In 2015, it was estimated

[15]France has vetoed several United Nations Security Council resolutions that would affirm Comorian sovereignty over Mayotte.

that 61 percent of the population in Mayotte had a connection to Comoros, with 42 percent born in Comoros, and an additional 19 percent having a Comorian mother (Marie et al., 2017). The routes used by Comorian migrants are depicted in Figure 6. Migrants typically converge to the south-east of Anjouan and then use small fishing boats, called *kwassa-kwassa*, to reach Mayotte. While this migration route has attracted scant international attention, tragic accidents of kwassas occasionally make the headlines of French newspapers (Le Monde, 2017). French Parliamentary reports usually cite figures ranging from several hundreds to one thousand deaths per year on this migration route (Sénat, 2001, 2008, 2012). However, because the majority of migrant deaths probably go unrecorded, there is no credible estimate of the number of fatalities.

Our qualitative survey provides sobering evidence on these migration flows. All respondents reported that using a kwassa from Anjouan to Mayotte is the only migration technology available to them. They perceive it as particularly risky and have many friends or relatives who died from a migration attempt to Mayotte (often in recent years). As a respondent put it: "*There is only one way to go to Mayotte, it is to take a kwassa. Only people with a normal situation can travel by plane or boat. The journey is so difficult and risky. I know many people who have lost their lives in this sea. The number of people in this village who died because of Mayotte is uncountable*". Although in theory legal migration pathways exist, in practice, respondents reported that the likelihood to get a visa to Mayotte is close to zero for poor Comorians. Migration costs are relatively high and typically depend on the number of migrants in the kwassa (the higher the number of individuals, the lower the price of the journey). Our qualitative evidence suggest that migration costs can go from a minimum of US$230 – if the kwassa is overloaded – to a maximum of US$1150 for a "VIP kwassa" (i.e. a kwassa with only a few migrants). Migrants generally finance these costs through their savings, the sale of livestock, and the help of relatives. In addition to the risk of dying en route, migrants face substantial risks of being arrested and expelled by the French police. According to official French statistics, each year, more than 20,000 illegal migrants are deported to Comoros. Several respondents to the qualitative survey alluded to these risks and possible consequences, as reflected in this quote: *"Sometimes, we sell high-value properties to pay transportation costs, and unfortunately we get arrested by the police and have to start again from scratch. In these cases, we are in a depressing situation with nameless regrets"*.

3.2 The Comoros Social Safety Net Program (SSNP)

The SSNP was initiated in 2015 by the Government of Comoros in collaboration with the World Bank. The main implementing agency was FADC (*Fonds d'Appui au Dveloppement Communautaire*) – renamed ANACEP (*Agence Nationale de Conception et d'Exécution de Projets*) in 2017. Prior to running this program, FADC had successfully implemented a variety of World Bank projects, including similar cash-for-work programs. The objectives of the SSNP were to improve poor communities' access to safety net and nutrition services, smooth consumption, and support the development of productive activities. While there was no explicit targets on emigration to Mayotte due to the political sensitivity of the topic, there was implicitly the hope that the program would deter migration flows.

The main component of the program provided cash-for-work (CFW) opportunities to poor households, i.e. cash transfers conditional on their participation in public works such as reforestation, water management, and terracing. Beneficiary households were entitled to send one able-bodied adult of their choice to public works. Households with no able-bodied adults received unconditional cash transfers. Cash-for-work activities were implemented in periods of 20 days with payments made at the end of each period by a local micro-credit institution known as MECK. From 2016 to 2018, households were provided with an average 60 days of work per year at the wage rate of US$2.3 for four hours of work per day.

A total of 69 rural villages were selected by FADC to receive the intervention. According to the national distribution formula, Grande Comore should receive 45 percent of the program funds, while Anjouan should receive 42 percent, and Moheli 12 percent. Based on these percentages, FADC selected the poorest villages using the poverty map drawn up by the Comorian national institute of statistics (known as IN-

SEED) in 2003/2004. In Table 1, we see that households of selected villages are much poorer than households of non-selected villages, with an overall poverty rate of 88.2% against 42.1%.

Table 1: Poverty rates in treated villages

	Non-CFW villages		CFW villages	
	Pop (hh)	Poverty rate	Pop (hh)	Poverty rate
Grande Comore	42,744	41.3%	5,435	80.6%
Anjouan	38,152	41.5%	4,778	95.6%
Moheli	4,987	55.0%	1,097	94.8%
Total	85,883	42.1%	11,310	88.2%

Notes: Authors' calculations based on the 2003/04 poverty mapping.

Within villages, the selection of beneficiaries relied on several steps and mechanisms. First, self-targeting was expected because of the labor requirement, the (non-monetary) front costs of applying, and the low wage rate for the public works. Second, village committees, in collaboration with project staff, applied specific selection criteria. There were four criteria and each could give one point to the household: (i) the household head attended primary school at most; (ii) the household has at least four children below 15 years of age; (iii) the household has children aged between 6 and 14 who are not enrolled in school; (iv) the household has no agricultural field. Based on these criteria, committees pre-selected the poorest 60 percent households in their villages. As there were more pre-selected households than CFW opportunities, the selection of beneficiaries lastly relied on a public lottery organized by committees and FADC's staff.

4 Experimental design and data

4.1 Empirical strategy

The impact evaluation has been designed as a multi-level randomized controlled trial. At the household level, beneficiaries were randomly selected from the group of 60% households who had been pre-selected by local committees (see Section 3.2 above). At the cluster level, villages were randomly assigned to receive either a low or high intensity treatment, in order to assess indirect effects. Specifically, in each village, one third or two thirds of the pre-selected were randomly assigned to the treatment. This means that overall 20% or 40% of eligible households were ultimately selected.[16]

These two levels of random assignment are core to the empirical strategy. Because of the random assignments, households and villages with different treatment conditions are similar in expectation in every respect except for their treatment status. Any difference in outcome between treatment and control groups after the program can thus be attributed to the difference in treatment. Below, we provide more details on how we estimate the direct, indirect and heterogeneous intention-to-treat (ITT) effects of the SSNP on migration, as outlined in our pre-analysis plan.[17]

4.1.1 Direct effects

First we estimate a regression equation of the following form to derive direct effects of the program:

$$y_{iv} = \beta_0 + \beta_1 CFW_{iv} + \delta^T X_{iv} + \varepsilon_{iv} \tag{17}$$

Where y_{iv} is the outcome of interest for household i in village v; CFW_{iv} is a dummy indicating whether household i in village v was assigned to the treatment group or not; X_{iv} is a vector of baseline covariates (included to improve precision); and ε_{iv} is the disturbance term. The direct effects of the program on the outcomes of beneficiaries are given by the coefficient β_1.

[16] The evaluation design also had a gender component. Households with both male and female potential workers chose one individual of each gender to be the potential beneficiary of the program. Then for these households, the gender of the main worker was randomly selected. In practice, however, the rule that the main worker should participate in the works was never enforced: households could send the person of their choice and, ultimately, the majority of households sent a female worker as the daily wage rate was mostly attractive for them. For this reason, the analysis of the gender randomization face power issues and is mostly inconclusive. Results, available upon request, are not reported in this paper due to space limitation.

[17] Our pre-analysis plan is available here: http://egap.org/registration/5302. Online Appendix B presents sub-analyses that were specified in the PAP but are not incorporated in the paper due to space limitation.

4.1.2 Indirect effects

Indirect average treatment effects (ITE) of the SSNP are ascertained by comparing the outcomes of households in high intensity villages with those of households in low intensity villages. Specifically, we estimate an equation of the following form:

$$y_{iv} = \beta_0 + \beta_1 CFW_{iv} + \beta_2 P_{40v} + \beta_3 CFW_{iv} * P_{40v} + \delta^T X_{iv} + \varepsilon_{iv} \tag{18}$$

Where y_{iv} is the outcome of interest for household i in village v; CFW_{iv} is a dummy indicating whether household i in village v was assigned to the treatment group or not; P_{40v} is a dummy variable at the village level indicating an assignment rate of 40% in village v; $CFW_{iv} * P_{40v}$ is thus a dummy for being assigned to treatment in a village with an assignment rate of 40%; X_{iv} is a vector of baseline covariates; and ε_{iv} is the disturbance term.

Equation 18 provides an estimation of ITE on both beneficiary and non-beneficiary households. ITE among non-beneficiary households are estimated by the parameter β_2, that is the effect of being assigned to the control group in a village where 40% of the eligible population was assigned to treatment, compared to being assigned to the control group in a village where only 20% of the eligible population was assigned to treatment. ITE among beneficiary households are given by $\beta_2 + \beta_3$, that is the effect of being assigned to treatment in a village where 40% of the eligible population was assigned to treatment, compared to being assigned to treatment in a village where only 20% of the eligible population was assigned to treatment.

4.1.3 Heterogeneous effects

Finally, we estimate heterogeneous effects with an equation of the following form:

$$\begin{aligned} y_{iv} = \beta_0 + \beta_1 CFW_{iv} + \beta_2 CHARACTERISTIC_{iv} + \\ \beta_3 CFW_{iv} * CHARACTERISTIC_{iv} + \delta^T X_{iv} + \varepsilon_{iv} \end{aligned} \tag{19}$$

Where y_{iv} is the outcome of interest for household i in village v; CFW_{iv} is a dummy indicating whether household i in village v was assigned to the treatment group or not; $CHARACTERISTIC_{iv}$ corresponds to the dimension of heterogeneity studied for household i in village v; $CFW_{iv} * CHARACTERISTIC_{iv}$ is their interaction; X_{iv} is a vector of baseline covariates; and ε_{iv} is the disturbance term. This equation tests whether the effects of the program is conditional on baseline characteristics. Because these baseline characteristics were of course not randomly allocated across households, this analysis of heterogeneous effects should be considered as exploratory and results should not be interpreted as causal. In order to limit omitted-variable concerns, we will include interaction terms of the dimension studied with other baseline characteristics: $X_{iv} * CHARACTERISTIC_{iv}$.

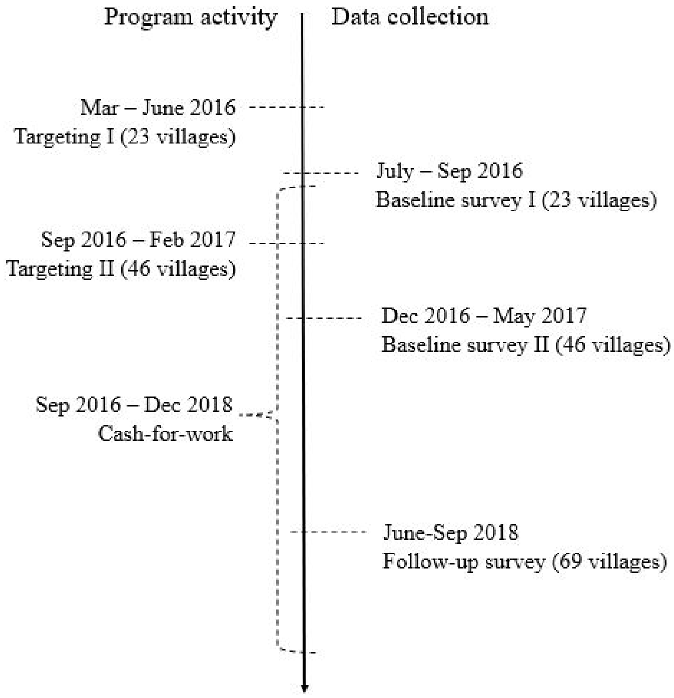
4.2 Data

The sample is composed of the villages targeted by the SSNP, with each village considered as a statistical domain. Village sizes below 30 households were excluded from the experimental design, since the number of beneficiaries would have been too small for public works. In these small villages, 100% of the eligible households participated in public works. The final sample is composed of 62 villages, including 37 villages from Grande Comore, 16 villages from Anjouan and 9 villages from Moheli. We performed power calculation exercises to determine the optimal number of households to include in the sample in order to both measure the impacts of CFW activities and minimize survey budget. In each village, we sampled 25 beneficiary households and 15 pre-selected but non-beneficiary households. All households within a given village and category had the same probability of being sampled.

A baseline survey was conducted after household randomization and before the launch of CFW activities. The baseline survey took place in two phases to mirror program implementation timeline:[18] (i) from July to September 2016 in one third of the villages and (ii) from December 2016 to May 2017 in the remaining two thirds. A follow-

[18]The sampling frame required the completion of the targeting process, which was implemented by FADC in two phases due to capacity constraints.

Figure 7: Timeline diagram



Source: Authors' elaboration

up survey was conducted between July and September 2018, while treated households received between US$140-320. Household attrition was low (about 4 percent of the baseline sample) and balanced across treatment and control groups.[19] INSEED, the national institute of statistics, was responsible for data collection and worked under the supervision of the authors. Enumerators were not informed of the treatment status of households prior to the interviews, and could thus only infer this information from questions related to CFW activities in the last module.

We implemented a qualitative survey as a complement to the quantitative survey. While the quantitative survey can provide rigorous estimates of impact, it is limited in its explanatory power to determine the mechanisms through which that impact occurred. Qualitative research is also useful to study perceptions, norms, and narratives, which are complex and difficult to quantify. About 90 semi-structured interviews were conducted by local research assistants under the supervision of the authors. The sample of the qualitative survey included a broad range of actors, including (i) participants

[19] Attrition will be discussed in depth in Section 5.3.

Table 2: Household characteristics at baseline

	Control		Treatment			
	Mean	SD	Mean	SD	Diff	p-value
Household size	6.55	2.80	6.57	2.82	-0.01	0.91
Consumption (PAE)	7.17	1.02	7.14	0.97	0.03	0.55
Has a bank account	0.28	0.45	0.27	0.45	0.01	0.64
Has an income generating activity (other than agriculture)	0.48	0.50	0.45	0.50	0.03	0.17
Owns fields	0.76	0.43	0.75	0.43	0.01	0.72
Livestock (tropical unit)	0.49	0.93	0.52	0.99	-0.03	0.48
Has electricity	0.59	0.49	0.60	0.49	-0.01	0.50
Has a private water access	0.63	0.48	0.63	0.48	0.01	0.74
Head is male	0.77	0.42	0.76	0.43	0.01	0.59
Head age	48.66	16.03	48.34	15.20	0.32	0.63
Head education						
Did not complete primary	0.56	0.50	0.58	0.49	-0.02	0.39
Primary	0.22	0.41	0.19	0.39	0.03	0.06*
Secondary	0.18	0.38	0.19	0.39	-0.01	0.48
Tertiary	0.04	0.20	0.04	0.20	-0.00	0.83
Willingness to migrate to Mayotte	0.21	0.41	0.23	0.42	-0.02	0.31
Migration experience to Mayotte	0.54	1.33	0.51	1.53	0.03	0.61
Migrant network in Mayotte	0.13	0.34	0.14	0.35	-0.01	0.49
Island of residence						
Ngazidja	0.58	0.49	0.58	0.49	0.00	0.84
Ndzuani	0.27	0.44	0.28	0.45	-0.01	0.58
Mwali	0.15	0.36	0.15	0.35	0.01	0.67
Debts	8.34	5.51	8.35	5.50	-0.01	0.96
F-test joint orthogonality						0.81
Observations	900	900	1372	1372	2272	2272

Notes: This table reports subsample means with standard deviations. The last column reports the pvalue of a ttest of mean equality across subsamples. The F-test corresponds to a regression of the treatment on baseline characteristics using the same specification as in equation 17 (*omnibus test*). An inverse hyperbolic sine transformation has been applied to consumption and debts. PAE denotes per adult equivalent.

and non-participants in project activities, (ii) government officials and local community leaders, and (iii) NGOs and local firms in charge of the execution of CFW activities. The qualitative work focused on 10 villages (4 in Grande Comore, 4 in Anjouan, and 2 in Moheli) and interviewed 6 beneficiaries (2 males, 2 females, and 2 individuals belonging to migrant households), 2 non-beneficiaries, and 1 community leader in each village.

Table 2 summarizes key baseline variables and tests for balance between treatment and control groups. The first four columns report subsample means and standard deviations, and the last two columns report the difference and associated p-values. Migration experience corresponds to the total number of attempts made by household members. We follow De Brauw and Carletto (2012) and proxy migration network using a dummy that equals one if the household head has one children residing in Mayotte. Only one of the 20 variables tested appears imbalanced (10% significance level). Household heads assigned to treatment are slightly less likely to have completed primary school only (19% vs. 22%). While significant, this difference is not too worrying because it concerns only one variable and because it is relatively small in size. More importantly, the *omnibus test* of joint orthogonality is not rejected (p=0.81). This suggests that the randomized assignment of households to treatment has been implemented correctly.

5 Results

5.1 Program take-up

In Table 3, we test whether households assigned to treatment were indeed more likely to perform CFW activities and whether an improvement of their levels of employment and income is observed. On one hand, access to CFW opportunities should directly increase employment and income levels of beneficiaries. On the other hand, substitution effects could undermine these direct effects, for example if beneficiaries gave up other profitable activities because of the labor requirement of the program. Our main outcome variables aggregate individual measures of employment and incomes at the household level.

In column 1 and 4, we see that the randomization was effective at driving treated households to participate in CFW activities. Households randomly assigned to treatment worked significantly more in public works than control households (p<0.001). However, some evidence of substitution effects can be seen from column 5. Treated households earned a lower total income than their control counterparts if cash-for-work income is excluded. These substitution effects are only visible for income, and

Table 3: Treatment effects on labor market outcomes

	Employment			Income		
	(1) CFW	(2) Total (excl. CFW)	(3) Total (incl. CFW)	(4) CFW	(5) Total (excl. CFW)	(6) Total (incl. CFW)
Panel A						
Treatment	4.990***	0.409	5.399***	1.284***	-0.261**	1.023***
	(0.317)	(1.617)	(1.664)	(0.074)	(0.115)	(0.138)
Extended controls	No	No	No	No	No	No
Island FE	No	No	No	No	No	No
Panel B						
Treatment	4.905***	0.472	5.377***	1.265***	-0.235**	1.029***
	(0.315)	(1.540)	(1.583)	(0.074)	(0.109)	(0.131)
Extended controls	Yes	Yes	Yes	Yes	Yes	Yes
Island FE	No	No	No	No	No	No
Panel C						
Treatment	4.918***	0.379	5.297***	1.268***	-0.239**	1.029***
	(0.313)	(1.510)	(1.556)	(0.073)	(0.107)	(0.129)
Extended controls	Yes	Yes	Yes	Yes	Yes	Yes
Island FE	Yes	Yes	Yes	Yes	Yes	Yes
Control mean	1.881	51.924	53.805	0.489	3.098	3.587
Observations	2181	2181	2181	2181	2181	2181

Notes: This table shows estimates of equation (17) using various employment and income variables as outcome variables. Employment variables are expressed as number of days worked. Total employment includes farming, livestock rearing, fishing, and other activities (and CFW if specified in the column header). An inverse hyperbolic sine (IHS) transformation has been applied to all income variables. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

are not sufficient to remove CFW positive direct effects. Overall, the total treatment effects on employment and income are substantial and positive (columns 3 and 6), such that the program can be considered as a large positive income shock. The estimates are similar when extended controls and island fixed effects are included in the specification (panels B and C).

The control group appears to have been slightly contaminated by the treatment. Control households reported an average of 1.88 days spent in public works during the month preceeding the survey. We further explore program take-up by looking at the treatment status reported by endline respondents themselves.[20] We find a non-compliance rate of 19.6% overall (14.7% in the treatment group; 27.2% in the control group). The main explanation for non-compliance is related to the replacements of drop-out beneficiaries. For example, a respondent from the qualitative survey reported

[20]Questions on the program were asked in the last module of the survey in order to avoid influencing the behaviors of respondents and interviewers in other modules.

that *"after a month, I received the 20,000 KMF [US$46] and decided to go back to my own farming because it was more profitable. My wife also didn't want to go to the public works. Then, another person took our place. I saw that the program was not going to help me on much"*.

As mentioned in Section 4.1, we will use ITT estimates in order to avoid biasing our evaluation of program effects. In robustness analysis, we will use the treatment randomly assigned as an IV for the treatment status actually observed in the survey to obtain local average treatment effects (LATE) of the program, i.e. the impact of the program on compliers.

5.2 Impact on migration

The main results of the paper are presented in Table 4, where we report the ITT effect of the SSNP on migration to Mayotte. We were concerned about the sensitivity of the topic because migration of Comorians to Mayotte is usually illegal, especially for the study population which is poorer than the average Comorian and has a tiny probability of getting visas. In addition, many people have died in the last few decades trying to reach Mayotte and development agencies are increasingly concerned by the phenomenon. In terms of identification, experimenter demand effects and socially desirable answers could induce beneficiary households to be more reluctant to reveal migration to Mayotte, and this in turn would lead to lower-bound estimates. In order to avoid respondents discomfort and biased responses, we collected information as indirectly as possible, by leveraging data on household composition collected at baseline. In particular, our main measure of migration relies on questions asking whether each baseline household member is still residing in the household at follow-up, and if not, where he or she is currently residing with Mayotte as one of the choices. Because it does not make salient that the purpose of the questions is to assess migration to Mayotte, we believe that this design limits the risks of respondents' discomfort and reporting bias.

Because the French police expels a large number of illegal Comorians every year,

Table 4: Treatment effects on migration to Mayotte

	Migration (excl. returns)			Migration (incl. returns)		
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	0.030**	0.028**	0.028**	0.036**	0.034**	0.033**
	(0.013)	(0.012)	(0.012)	(0.015)	(0.015)	(0.015)
Extended controls	No	Yes	Yes	No	Yes	Yes
Island FE	No	No	Yes	No	No	Yes
Control mean	0.078	0.078	0.078	0.128	0.128	0.128
Observations	2181	2181	2181	2181	2181	2181

Notes: This table reports LPM estimates of treatment effects on migration using equation (17). The dependent variable in columns 1 to 3 is a dummy equal to one if at least one household member migrated to Mayotte after the baseline survey and is still in Mayotte during the follow-up survey. In columns 4 to 6, the dependent variable also equals one if at least one household member migrated to Mayotte after the baseline survey but returned to his household of origin (voluntarily or not). Extended controls include the following variables (measured at baseline): household willingness to migrate; migration experience; network in Mayotte; household head's gender, age, and schooling; household size, consumption, and livestock; dummy variables equal to one if the household has a bank account, income-generation activities (other than agriculture), fields, electricity, and a private water access. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

migration is often short-term.[21] Therefore, we also collected information on return migrants, by inquiring whether any household member at follow-up took a *kwassa* for Mayotte in the last 24 months. This measure is not without caveats and could bias the estimates, given that (i) it is more direct and thus exposed to the reporting bias mentioned above, (ii) the 24 months recall period may include pre-program migrations because of program's progressive roll-out, and (iii) it does not inquire about household members who have died (some of which may have died en route to Mayotte), or household members who have left the household and are not currently in Mayotte, but could still have been in Mayotte in between.[22] These caveats are likely to attenuate our estimates of treatment effects.

We find that the program had a sizable and positive impact on migration to Mayotte. Column 1 shows that the treatment increased migration to Mayotte by three percentage points (significant at the 5% level), which represents a 38 percent increase rela-

[21]Each year, about 20,000 migrants are deported to Comoros (Sénat, 2008). This corresponds to roughly 8 percent of Mayotte population or 2.5 percent of Comoros population.

[22]Comorian migrants are always deported to Anjouan (Mayotte's closest neighbor), even though they are from Grande Comore or Moheli. Then, they either return to their island of origin, settle in a new location, or try to get back to Mayotte.

tive to the control group. Results are robust to the inclusion of returnees. Estimates of treatment effects are larger in absolute terms but smaller in relative terms (consistent with the attenuation bias highlighted above). As can be seen in column 4, the program increased migration by 3.7 percentage points, equivalent to a 29 percent increase relative to the control group. Results are stable when extended controls and island fixed effects are included (columns 2, 3, 5 and 6). Table A1 shows LATE effects of the program. Not surprisingly, LATE estimates are consistently larger than ITT estimates suggesting that the program increased migration within the sample of compliers.

5.3 Threats to our interpretation

These results are consistent with the idea that the cash-for-work program increased migration to Mayotte. However, this interpretation is exposed to various threats that could produce a similar pattern in the data. We explore three alternative explanations for the observed effects: (i) selective attrition; (ii) selective household dissolution; (iii) negative indirect effects on control households.

Selective attrition Because attrition can sometimes be explained by whole household migration, a typical concern with impact evaluation looking at migration is related to differential attrition rates between experimental groups. In our case, if households in the control group were more affected by whole household migration than households in the treatment group, our estimates would be biased upwards. A few observations help to mitigate this concern. First, the attrition rate is very low (about 4%) and similar across experimental groups (Table A2). Moreover, qualitative interviews indicate that whole household migration to Mayotte is uncommon. Households typically send one migrant, two at most (when a parent migrates with his or her child). As a respondent put it: *"I do not know of any family that has migrated entirely to Mayotte. Most often, there is only one person who migrates because that is enough to help other."* Many respondents also mentioned the high migration costs and risks to explain that whole household migration is unusual. Finally, even if we considered an unlikely scenario in which all attritors migrated to Mayotte, we would still observe a positive impact on migration.

Selective household dissolution A similar concern is related to household dissolution and migration. As shown by Bertoli and Murard (2019), the migration of an individual increases the probability that his or her household of origin dissolves subsequently. Because the program was targeted at the household level, beneficiary households may have had an incentive to preserve their living arrangements after the migration of a household member, thus being relatively less likely to dissolve. Again, this would lead to a relatively higher attrition rate in the control group and would bias our results upwards. In Table A3, we check whether beneficiary households are less likely to dissolve by analyzing attrition reasons given by enumerators. Reassuringly, household dissolution was similar in the control and treatment groups. About two percent of households in both experimental groups could not be followed-up because they dissolved.[23]

Negative indirect effects on control households A number of recent studies highlight the importance to estimate not just direct effects of anti-poverty programs but also their indirect effects (Angelucci and De Giorgi, 2009; Beegle et al., 2017). Indirect negative effects would bias our results upwards if they were more prevalent for control households. For instance, control households could be hurt by price spikes or increased competition for scarce investment opportunities. We estimate indirect effects using equation (18). Table A4 reports the sign and magnitude of indirect effects for both experimental groups. We see no evidence of significant indirect treatment effects. If anything, these affects are small and similar across treatment and control groups.

[23]Two ingredients of the project implementation may explain this pattern. First, payments were made to individuals performing the work rather than to household heads. Second, formal and informal arrangements to replace workers were possible both within and across households. Drop-out workers were supposed to be replaced by another adult household member, but in practice, FADC did not keep track of the exact initial household composition, meaning that the choice of the replacement could incorporate endogenous household changes. The qualitative interviews with beneficiaries reveal that replacements by extended family members or relatives were quite common. Taken together, these observations support the idea that incentives for beneficiaries to preserve the household structure were likely weak in practice.

6 Channels

Various channels may explain why the cash-for-work program increased migration to Mayotte.[24] We explore the four channels highlighted in our conceptual framework (Section 2): (i) the liquidity channel; (ii) the opportunity cost channel; (iii) the credit constraint channel; and (iv) the risk-aversion channel.[25] The evidence suggests that the increase in migration is explained by the alleviation of liquidity and risk constraints on one hand, and by the fact that the program did not increase the opportunity cost of the individuals who were the most likely to migrate on the other hand.

6.1 Liquidity channel

According to the liquidity channel, cash transfers relax the budget constraint households, thus facilitating the migration of those unable to finance migration without the transfers. In order to check whether this channel is relevant in our setting, we estimate program effects conditional on baseline savings using equation (19).[26] Figure 8 shows follow-up migration rates and treatment effects conditional on baseline savings.[27] In line with the liquidity channel, Figure 8 shows that the positive effects on migration are concentrated within the group of households with low baseline savings. In addition, the migration rate in the control group was relatively higher for households with high baseline savings, suggesting that financial constraints are binding in our setting. Overall, it seems that cash transfers allowed some households with low levels of savings at baseline to overcome otherwise binding financial constraints. Table A5 shows

[24]This section should be regarded as exploratory since it was not included in our pre-analysis plan.

[25]In this section, we focus on our first definition of migration (i.e. excluding return migrants) due to space limitation. Results including return migrants are similar (available upon request).

[26]It is often challenging to measure savings, especially in low-income settings where it can take various forms. In Comoros, households typically save using livestock and tontines. In addition, many households take on debts from various operators (friends, shop owners, etc.) such that their savings can actually be negative. In order to capture household net savings, we derive a variable combining the value stored in these various vehicles. Specifically, the money saved in livestock and tontines enter positively in the variable, whereas the amount of debts enter negatively.

[27]According to the theoretical model in Section 2, the relationship between savings and migration in t_2 can be non-linear. In Figure A1 in appendix, we test for the presence of a non-linear relationship by splitting the sample into three groups according to their baseline level of savings. Results are qualitatively similar.

that these results are qualitatively unchanged using more parsimonious specifications of equation (19) and a continuous variable for savings.

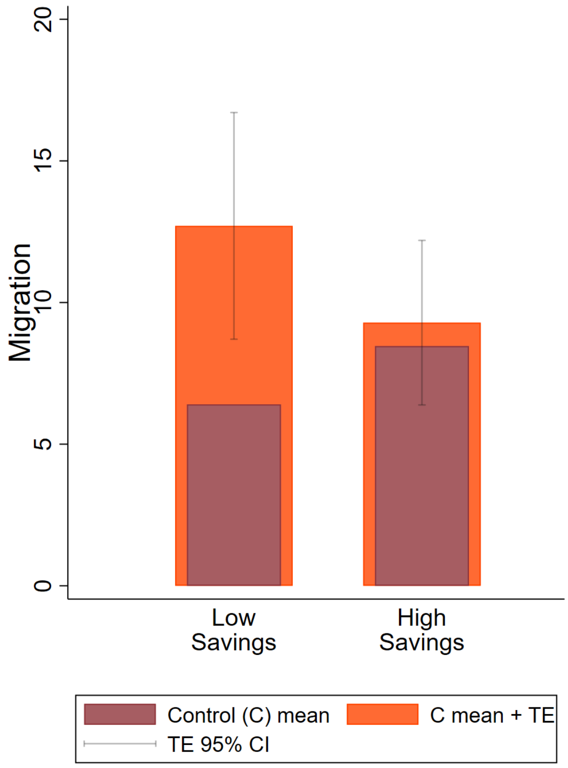


Figure 8: Liquidity channel

Notes: This figure shows follow-up household migration rates conditional on baseline savings. Households are divided in two groups depending on their levels of savings at baseline. Low (resp. high) savings correspond to savings below (resp. above) mean savings. An IHS transformation was applied in order to limit the influence of outliers. Treatment effects and 95% confidence intervals are derived from the estimates of Equation (19) including all controls (balanced covariates, island fixed effects, and their interactions with savings). N = 2181.

Our second approach to investigate the liquidity channel is to look at program effects on migration to other destinations. If the increase in migration to Mayotte is due to relaxed financial constraints, we should not detect similar effects on migration to cheaper, previously unconstrained destinations. As can be seen from Table 5, the program had small and non-significant effects on domestic migration. We do not observe effects on migration to mainland France either, most likely because the binding constraint for this destination is administrative rather than financial. The absence of impact on migration to other destinations could also be due to the fact that Comorians typically migrate legally to these destinations, implying that there is less uncertainty in the migration outcome and that the risk-aversion channel could be inactive (see Section

6.4 below).

Table 5: Other migration patterns

	(1) Domestic Mig. (intra-island)	(2) Domestic Mig. (inter-island)	(3) Migration France	(4) Migration Other
Treatment	-0.023	0.007	-0.001	0.002
	(0.018)	(0.010)	(0.007)	(0.007)
Extended controls	Yes	Yes	Yes	Yes
Island FE	Yes	Yes	Yes	Yes
Control mean	0.236	0.057	0.029	0.030
Observations	2181	2181	2181	2181

Notes: Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. See notes to Table 4 for more details.

6.2 Opportunity cost channel

As shown is Section 2.2, cash transfers that are conditional on remaining in the origin country increase the opportunity cost of migrating and could therefore reduce migration. We argue that this channel has not been operating in our setting because the cash-for-work program was very flexible. Beneficiary households were entitled to send one adult of their choice to public works and, most importantly, the cash transfers were not conditional upon other household members staying in Comoros. Beneficiary households could therefore select one household member to participate in public works activities, and, in the meantime, use the cash transfers to finance the migration of another household member. This conjecture is reinforced by qualitative evidence, which suggests that people are financing the migration of others: *"I gave 40,000 KMF [US$92] to my son for his trip to Mayotte. Life is hard. We had no one to ask for help. My son decided alone to leave in the hope of helping us. I didn't have much. But to encourage him, I gave this small amount"*.

Although in theory the cash-for-work program could have still increased the opportunity cost of migrating for the participants in CFW activities, in practice CFW workers were very different from the average migrant. As can be seen in Table 6, workers were on average older and less educated than migrants, and most workers were females with no migration experience while a majority of migrants were males. This suggests that the program primarily increased the opportunity cost of individuals who were unlikely to migrate (i.e. relatively old and lowly educated females with no previous migration experience). Table 6 actually suggests that participation in CFW activities did not deter migration at all, since treated and control migrants are very similar. If CFW participation reduced the migration rate of workers, we would expect the differences between control migrants and workers to be smaller than the differences between treated migrants and workers. We find little evidence to suggest this pattern except for the dummy indicating whether individuals had an income-generating activity other than agriculture at baseline.

Table 6: Summary statistics on project workers and migrants

	Treated			Controls
	Non-migrants		Migrants	Migrants
	Worker=1	Worker=0		
Age	39.56	30.30	28.73	29.18
Male	0.22	0.60	0.59	0.56
Education				
Did not complete primary	0.56	0.26	0.28	0.25
Primary	0.25	0.19	0.28	0.35
Secondary	0.17	0.44	0.38	0.33
Tertiary	0.03	0.11	0.06	0.07
IGA	0.24	0.20	0.14	0.22
Migration experience	0.07	0.06	0.29	0.30
Observations	991	3166	196	105

Notes: The sample is restricted to adults (15-65 at baseline).

6.3 Credit constraint channel

According to the credit constraint channel, cash transfers may facilitate access to credit and thereby increase migration of credit constrained households as soon as they are selected to benefit from the program. Our evidence suggests that the credit constraint channel was negligible in this study. First, control and treated households had similar baseline levels of debts (Table 2), suggesting that beneficiary households had not yet altered their financial behaviors at the time of the baseline survey although they already knew they would benefit from the cash transfers. Second, the additional migration episodes induced by the treatment appear to be financed through savings or transfers from relatives, but not by increased access to credit (see Table A6). Finally, when respondents reported a migrant, we further inquired about the month and year of migration. This retrospective data allows us to explore the evolution of the treatment effect over time. Figure 9 shows, for each quarter between July 2016 and September 2018, the treatment effect along with the migration rate in the control group.[28] Figure 9 also shows the timing of cash transfers, measured using administrative data. Overall, we see that the treatment effect increased over time, and that the correlation with cash transfers disbursement is rather strong: increases in treatment effect follow closely the disbursement of cash transfers.

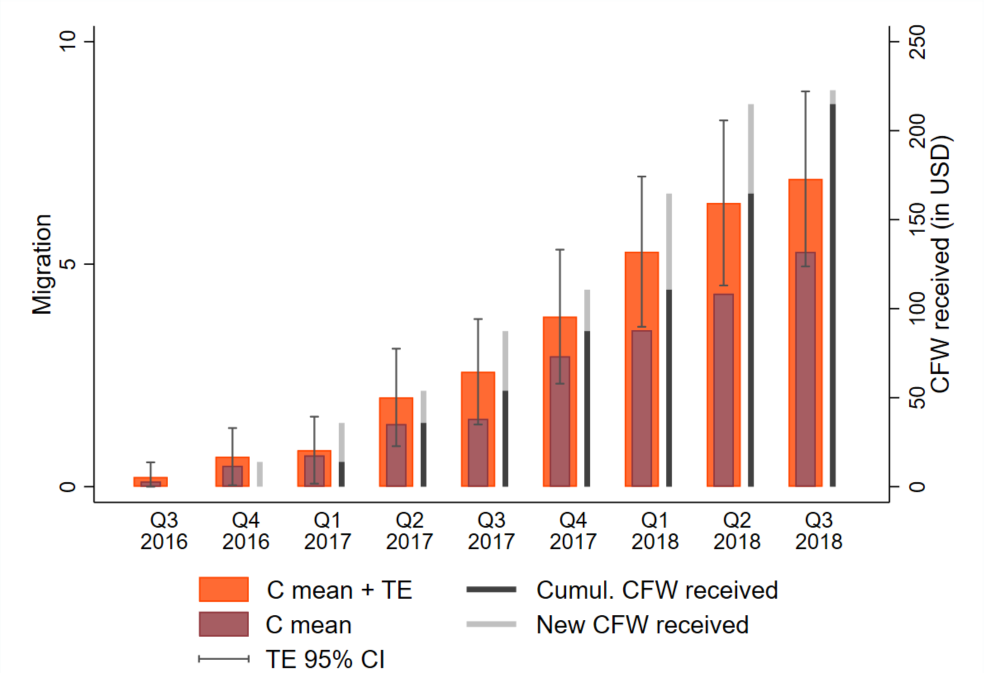


Figure 9: Treatment effect over time

Notes: This figure shows the evolution of follow-up households' migration rates over time. Treatment effects and 95% confidence intervals are derived from the estimate of equation (17) including all controls (extended covariates and island fixed effects). N = 2181.

In order to have a better understanding of these dynamics, Table 7 investigates in a more systematic way the timing of cash transfers and migration. We assemble a panel with detailed information about the history of migration and cash transfers. We are particularly interested to check (i) whether migration decisions at time t are explained

[28]The treatment effect and the control mean in the last period (Q3 2018) are lower than in Table 4 because 25 percent of the respondents only recalled the year of migration and are thus excluded from the pool of migrant households for this analysis. As a robustness check, we replaced missing month by a randomly generated month. Results, available upon request, show that the dynamic of the treatment effect is the same though the estimates are more precise.

by the amount of cash received at time *t*, the cash received at time *t*-1, or the total cash received pre-*t*, and (ii) whether the impact of the cash received at time *t* is conditional on the total amount of cash received beforehand. In column 1, we see that most of the impact seems to come from cash received at time *t*, meaning that individuals reacted rather quickly to cash transfers. In contrast, cash transfers received at time *t*-1 did not seem to make much difference (column 2). However, it is interesting to see in column 3 that the impact of cash received at time *t* is actually conditional on the total amount received beforehand. Overall, it seems that migration occurred in time periods where households received cash conditional on having accumulated enough liquidity in the previous periods. This pattern suggests that liquidity constraints rather than credit constraints may have been alleviated by the program. If anything, this evidence reinforces the relevance of the liquidity channel (Section 6.1).

Table 7: Timing of cash transfers and migration

	Migration t		
	(1)	(2)	(3)
Cash t	0.0044***	0.0049***	0.0002
	(0.002)	(0.002)	(0.002)
Cash Tot. t-1	0.0007		-0.0003
	(0.000)		(0.000)
Cash t-1		-0.0033	
		(0.002)	
Cash Tot. t-2		0.0014*	
		(0.001)	
Cash t x Cash Tot. t-1			0.0027***
			(0.001)
Migration t-1	0.982***	0.981***	0.982***
	(0.002)	(0.003)	(0.002)
Extended controls	Yes	Yes	Yes
Island FE	Yes	Yes	Yes
Control mean	0.023	0.023	0.023
Observations	17304	15141	17304

Notes: Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

6.4 Risk-aversion channel

As shown in our simple theoretical model, if migration is risky and households have DARA preferences, the cash transfers reduce risk-aversion and thereby increase the expected utility returns from migration. This risk-aversion channel is particularly relevant in our context, as Comorians migrating to Mayotte face considerable risks of death or expulsion. As emphasized in Section 3.1, thousands of Comorian migrants have died in the attempt to reach Mayotte, and even more have been arrested and deported to Comoros. Qualitative interviews suggest that these risks have a strong influence on migration decisions, as illustrated in the following quote: *"There are two things that automatically get inside the minds of the person who wants to migrate and his family: the risk of dying in the sea which is very common; the risk of being arrested by the police which can be really painful considering the expenses incurred"*. In addition, we believe that it is reasonable to assume DARA preferences in a setting suffering from widespread poverty and a lack of formal social safety nets. In this context, many households could face a *"subsistence constraint"*, defined by Bryan et al. (2014) as a situation where poverty is so strong that failed investments would lead to unbearable welfare losses.

To investigate this channel, we estimate program effects conditional on a proxy measure of risk-aversion at baseline. Our measure of risk-aversion is derived from a simple discrete choice experiment conducted on the sub-sample of households willing to migrate by kwassa at baseline (21.8% of the sample or 476 households). Respondents were asked to make a choice about the number of persons in the kwassa. Our qualitative evidence indicates that aspiring migrants typically face this choice in the real world and trade-off migration costs and migration risks. The more persons in a kwassa, the lower the price of the journey but the higher the risks of accident or arrest. Respondents were presented with three choices: (1) an overloaded kwassa (the less expensive but most risky technology); (2) a properly loaded kwassa; (3) what is often called a VIP kwassa, i.e. a kwassa with very few people (the most expensive but less risky technology). The exact question was as follows:[29]

> *Imagine that you should take a small kwassa to migrate to Mayotte. The maximum capacity of the kwassa is 10 persons. You have the choice between three prices:*
>
> 1. *You pay 100,000 KMF [US$230] and more than 10 persons on the kwassa*
> 2. *You pay 250,000 KMF [US$575] and between 5 to 10 persons on the kwassa*
> 3. *You pay 500,000 KMF [US$1150] and less than 5 persons on the kwassa*

[29] These choices have been calibrated during enumerators' training and the pilot survey to reflect real world choices in as much as possible.

Which option would you choose?

Overall, 50.1% of the respondents selected choice (1), 20.6% choice (2), and 28.3% choice (3). We estimate a simple regression of the choice on baseline consumption and use the residuals as a proxy of risk-aversion. In other words, risk-aversion is derived from the part of the choice that is not explained by household wealth.[30] Figure 10 shows follow-up migration rates and treatment effects conditional on baseline risk-aversion. In line with the risk-aversion channel, positive effects of the program on migration are concentrated within the group of households with high levels of risk-aversion at baseline.[31] In the control group, migration is lower among the highly risk-averse, which is consistent with DARA preferences and the theoretical result that risk adversity is a barrier to migration. Table A7 shows that these results are qualitatively unchanged using more parsimonious specifications of equation (19) and a continuous variable for risk-aversion.

[30]In line with our expectations, we find that choosing a less risky option is strongly and positively associated with baseline consumption levels ($p<0.001$; results available upon request).

[31]According to the theoretical model, the heterogeneous treatment effect with risk-aversion could be non-linear. Highly risk-averse households do not migrate in t_2 even with the cash transfers. Households with intermediate levels of risk-aversion do not migrate in t_1 but migrate in t_2 if they receive the cash transfers. Households with low level of risk-aversion migrate in t_1 and hence do not respond to the treatment. In Figure A2 in appendix, we test for the presence of such non-linear heterogeneous treatment effect by splitting the sample into three groups according to their baseline level of risk aversion. Results are qualitatively similar, suggesting that the heterogeneous treatment effect with risk-aversion is mostly linear in our context.

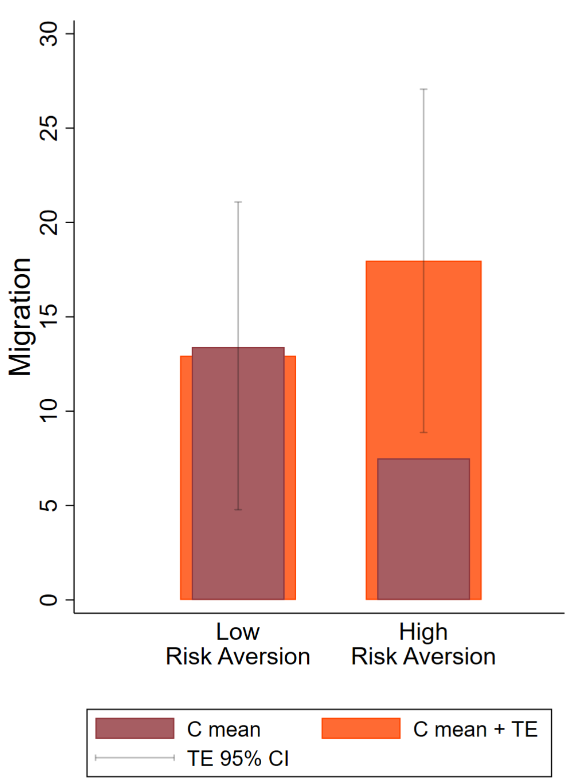


Figure 10: Risk-aversion channel

Notes: This figure shows follow-up household migration rates conditional on baseline risk-aversion. Households are divided in two groups depending on their levels of risk-aversion at baseline. Low (resp. high) risk-aversion corresponds to risk-aversion below (resp. above) mean risk-aversion. Treatment effects and 95% confidence intervals are derived from the estimate of equation (19) including all controls (balanced covariates, island fixed effects, and their interactions with risk-aversion). N = 476.

7 Conclusion

Although international migration can lead to large income gains (McKenzie et al., 2010; Clemens, 2011; Gibson and McKenzie, 2012), existing migration flows remain relatively limited compared to the 750 million aspiring migrants (Esipova et al., 2018). The low realization rates are partly explained by policy barriers (Clemens, 2011), by binding liquidity and credit constraints (Angelucci, 2015; Bazzi, 2017; Cai, 2018), and by the high perceived risks of migration (Bah and Batista, 2018). The growing number of cash transfer programs in low- and middle-income countries could relax some of these constraints and further fuel international migration. Yet, empirical evidence on the link between cash transfers and international migration is limited (Adhikari and Gentilini, 2018).

In this paper, we showed that cash transfers targeted to very poor households in

Comoros increased migration to the neighboring and richer French island of Mayotte. This increase in migration can be explained by the alleviation of liquidity and risk constraints on one hand, and by the fact that the program did not increase the opportunity cost of the persons who were the most likely to migrate on the other hand. The effect of the cash transfers on migration to Mayotte is significantly larger for households with low levels of savings at baseline, or high levels of risk-aversion at baseline. This suggests that cash transfers ease liquidity and risk constraints and thereby increase (costly and risky) migrations. Although, in theory, the labor requirement of the program could have reversed these effects by increasing the opportunity cost of migrating, the participants were in practice very different from the average migrant.

These findings confirm that many households do not migrate because of binding liquidity constraints (Angelucci, 2015; Bazzi, 2017). It also contributes to the nascent literature showing that risk is an important deterrent in the decision to migrate (see e.g. Bryan et al. 2014; Kleemans 2015; Dustmann et al. 2017). While our findings confirm that risk is an important barrier to migration, they also suggest that a social protection program such as the SSNP can ease risk aversion and thereby increase risky migrations.

Recognizing the diversity of policy preferences over migration and the sensitivity of the topic, we refrain from proposing policy recommendations. Instead, we conclude by discussing several questions that were beyond the scope of this paper due to lack of data or insufficient statistical power, but that are nonetheless essential to better understand the relationship between cash-based programming and migration. We highlight three fruitful areas of future research. First, it would be useful to document the welfare consequences for households investing in migration. Bryan et al. (2014) and Meghir et al. (2019) investigate this question through a program that provides small transport subsidies to potential seasonal migrants in Bangladesh. Our study is not powered to explore this important question. A related and second issue concerns potential labor re-allocation for households affected by out-migration. While this is not something that our study can directly investigate, other studies have found troubling patterns necessitating policy correction. For instance, in their investigation of migrant households in rural China, Mu and Van de Walle (2011) identify a re-allocation of traditional farm labor among women in households affected by the migration of another member of the household, whereby the women left behind were doing more farm-work than would have been the case. It is possible migration induced by participation in a cash-for-work programs may produce similar dynamics and effects on for women left behind and it is important to document any such effects. Finally, future empirical studies should focus on better understanding possible differential migration decisions by individuals and households. Our study assumed that migration choices are similar for the household as a unit and for individual members. Yet, empirical studies such as Dustmann et al. (2017) have shown that the relation between individual preferences and households' migration decision are complex. Future research should investigate individual preferences interact with cash-for-work programs to influence migration decisions.

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Table A1: IV estimates

	Migration (excl. returns)			Migration (incl. returns)		
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	0.051**	0.048**	0.048**	0.063**	0.058**	0.058**
	(0.022)	(0.021)	(0.021)	(0.026)	(0.025)	(0.025)
Extended controls	No	Yes	Yes	No	Yes	Yes
Island FE	No	No	Yes	No	No	Yes
Control mean	0.078	0.078	0.078	0.128	0.128	0.128
Observations	2181	2181	2181	2181	2181	2181

Notes: This table reports LATE estimates of the program. Random assignment is used as an IV for actually treated households (according to survey data). See notes to Table 4 for other details. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A2: Differential attrition test

	Control		Treatment			
	Mean	SD	Mean	SD	Diff	p-value
Attrition rate	0.044	0.206	0.037	0.189	0.007	0.39
Observations	900	900	1372	1372	2272	2272

Notes: This table displays the difference in mean attrition between treatment and control groups.

Table A3: Attrition reasons

	Control		Treatment			
	Mean	SD	Mean	SD	Diff	p-value
Attrition reason						
Duplicate household	0.002	0.047	0.002	0.047	0.000	0.99
Refusal	0.007	0.081	0.004	0.066	0.002	0.46
Absent	0.009	0.094	0.009	0.093	0.000	0.97
Dissolved household	0.020	0.140	0.019	0.136	0.001	0.86
Too sick	0.001	0.033	0.001	0.027	0.000	0.76
Other	0.006	0.074	0.002	0.047	0.003	0.19
Observations	900	900	1372	1372	2272	2272

Notes: This table displays difference in mean attrition rates between treatment and control groups by attrition reasons.

Table A4: Indirect treatment effects

	Migration (excl. returns)			Migration (incl. returns)		
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	0.033	0.033	0.033*	0.032	0.033	0.032
	(0.022)	(0.021)	(0.017)	(0.028)	(0.027)	(0.021)
40% villages (β_2)	-0.002	-0.002	-0.003	-0.007	-0.006	-0.008
	(0.023)	(0.019)	(0.018)	(0.028)	(0.025)	(0.023)
Treatment x 40% villages (β_3)	-0.006	-0.009	-0.009	0.009	0.003	0.003
	(0.026)	(0.025)	(0.024)	(0.036)	(0.035)	(0.029)
$\beta_2 + \beta_3$	-0.007	-0.011	-0.012	0.002	-0.003	-0.005
	(0.024)	(0.018)	(0.016)	(0.031)	(0.021)	(0.020)
Extended controls	No	Yes	Yes	No	Yes	Yes
Island FE	No	No	Yes	No	No	Yes
Control mean (in 20% villages)	0.079	0.079	0.079	0.131	0.131	0.131
Observations	2181	2181	2181	2181	2181	2181

Notes: This table reports LPM estimates of indirect treatment effects using equation (18). See notes to Table 4 for other details. Standard errors in parentheses are clustered at the village level. *** p<0.01, ** p<0.05, * p<0.1.

Table A5: Liquidity channel

	Migration (excl. returns)					
	(1)	(2)	(3)	(4)	(5)	(6)
Savings (dummy):						
Treatment (β_1)	0.062***	0.063***	0.063***			
	(0.020)	(0.020)	(0.020)			
High savings	0.025	0.027	0.032			
	(0.019)	(0.019)	(0.171)			
Treatment × High savings (β_3)	-0.051**	-0.053**	-0.055**			
	(0.025)	(0.025)	(0.025)			
$\beta_1 + \beta_3$	0.011	0.010	0.008			
	(0.015)	(0.015)	(0.015)			
Control mean (low savings)	0.064	0.064	0.064			
Savings (continuous):						
Treatment (β_1)				0.038***	0.039***	0.038***
				(0.013)	(0.013)	(0.013)
Savings				0.001	0.001	0.001
				(0.001)	(0.001)	(0.007)
Treatment × Savings (β_3)				-0.002*	-0.002*	-0.002*
				(0.001)	(0.001)	(0.001)
Control mean (savings = 0)				0.073	0.073	0.073
Extended controls	✓	✓	✓	✓	✓	✓
Island FE		✓	✓		✓	✓
Savings × Controls			✓			✓
Observations	2181	2181	2181	2181	2181	2181

Notes: This table reports LPM estimates of conditional effects using equation (19). See notes to Table 4 for other details. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

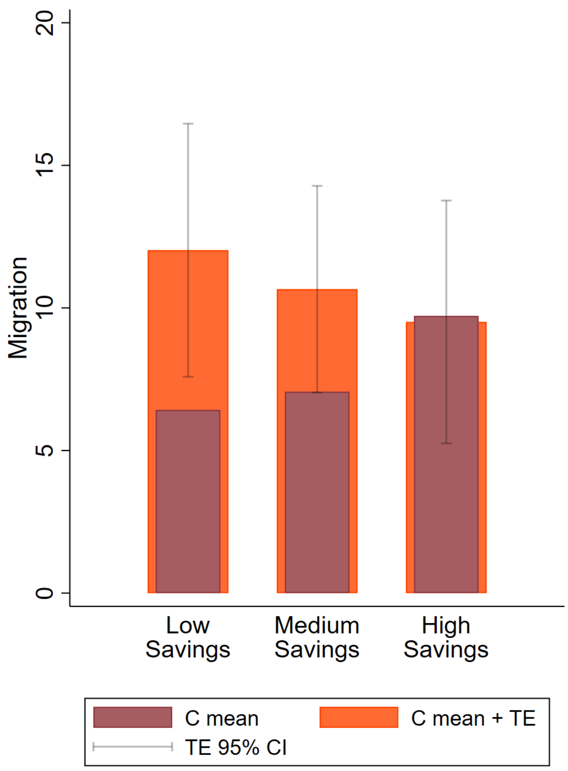

Figure A1: Liquidity channel - three groups

Notes: This figure shows follow-up household migration rates conditional on baseline savings. Households are divided in three groups of equal size. An IHS transformation was applied in order to limit the influence of outliers. Treatment effects and 95% confidence intervals are derived from the estimates of Equation (19) including all controls (balanced covariates, island fixed effects, and their interactions with savings). N = 2181.

Table A6: Treatment effects by means of financing

	Migration (excl. returns)		
	(1)	(2)	(3)
	Savings	Debts	Help
Treatment	0.014**	0.001	0.014*
	(0.007)	(0.008)	(0.008)
Extended controls	Yes	Yes	Yes
Island FE	Yes	Yes	Yes
Control mean	0.021	0.035	0.028
Observations	2163	2163	2163

Notes: Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

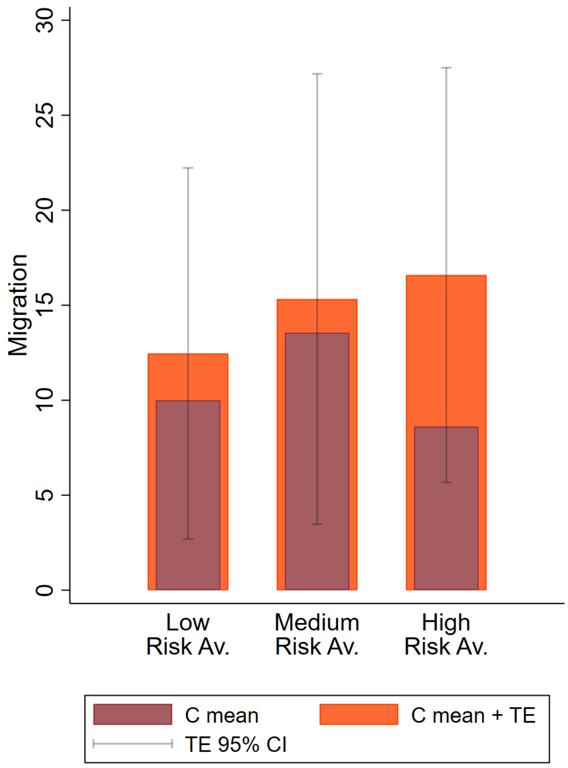

Figure A2: Risk-aversion channel - three groups

Notes: This figure shows follow-up household migration rates conditional on baseline risk-aversion. Households are divided in three groups of equal size. Treatment effects and 95% confidence intervals are derived from the estimate of equation (19) including all controls (balanced covariates, island fixed effects, and their interactions with risk-aversion). N = 476.

Table A7: Risk aversion channel

	Migration (excluding returns)					
	(1)	(2)	(3)	(4)	(5)	(6)
Risk aversion (dummy):						
Treatment (β_1)	0.001	0.002	-0.005			
	(0.042)	(0.042)	(0.041)			
High risk aversion	-0.093**	-0.091**	-0.522			
	(0.046)	(0.046)	(0.393)			
Treatment × High risk aversion (β_3)	0.102	0.101	0.109*			
	(0.063)	(0.063)	(0.062)			
$\beta_1 + \beta_3$	0.103**	0.103**	0.105**			
	(0.045)	(0.046)	(0.046)			
Control mean (low risk aversion)	0.134	0.134	0.134			
Risk aversion (continuous):						
Treatment (β_1)				0.047	0.047	0.033
				(0.030)	(0.030)	(0.033)
Risk aversion				-0.044	-0.043	-1.389
				(0.026)	(0.027)	(0.844)
Treatment × Risk aversion (β_3)				0.041	0.041	0.029
				(0.036)	(0.036)	(0.035)
Control mean (risk aversion = 0)				0.107	0.107	0.107
Extended controls	✓	✓	✓	✓	✓	✓
Island FE		✓	✓		✓	✓
Risk aversion × Controls			✓			✓
Observations	476	476	476	476	476	476

Notes: This table reports LPM estimates of conditional effects using equation (19). See notes to Table 4 for other details. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

For Online Publication: Online Appendix

A Mathematical Appendix

A.1 Proof of Proposition 1

The lifetime utilities of financing migration in t_1 (Case 1), financing migration in t_2 (Case 2), or not migrating at all (Case 3) are:

$$
\begin{aligned}
U^{Case1} &= u(s_0 - c + 2w_d) \\
U^{Case2} &= u(s_0 - c + w_o + w_d) \\
U^{Case3} &= u(s_0 + 2w_o)
\end{aligned}
$$

Case 1: migration in t_1 Financing migration in t_1 is only feasible if the initial level of savings s_0 is large enough to finance the upfront cost of migration ($s_0 \geq c$). If feasible, a household member migrates in t_1 if:

$$
\begin{cases}
U^{Case1} > U^{Case2} \Leftrightarrow w_d - w_o > 0 \\
U^{Case1} > U^{Case3} \Leftrightarrow 2(w_d - w_o) > c
\end{cases}
$$

Case 2: migration in t_2 Financing migration in t_2 is only feasible if the household can save enough in t_1 to pay the upfront cost of migration in t_2 ($s_0 + w_o > c$). If $s_0 \geq c$, migrating in t_1 is always preferable to migrating in t_2. If $c - w_o \leq s_0 < c$, a household member migrates in t_2 if:

$$
U^{Case2} > U^{Case3} \Leftrightarrow w_d - w_o > c
$$

A.2 Proof of Proposition 2

The lifetime utilities of financing migration in t_1 (Case 1), financing migration in t_2 (Case 2), or not migrating at all (Case 3) are:

$$
\begin{aligned}
U^{Case1} &= u(s_0 - c + 2w_d + \tau) \\
U^{Case2} &= u(s_0 - c + w_o + w_d + \tau) \\
U^{Case3} &= u(s_0 + 2w_o + \tau)
\end{aligned}
$$

Case 1: migration in t_1 Financing migration in t_1 is only feasible if the initial level of savings s_0 is large enough to finance the upfront cost of migration ($s_0 \geq c$). This budget constraint is not affected by the unconditional cash transfer, as it is received after the decision to migrate in t_1. If feasible, a household member migrates in t_1 if:

$$
\begin{cases}
U^{Case1} > U^{Case2} \Leftrightarrow w_d - w_o > 0 \\
U^{Case1} > U^{Case3} \Leftrightarrow 2(w_d - w_o) > c
\end{cases}
$$

Case 2: migration in t_2 Financing migration in t_2 is only feasible if the household can save enough in t_1 to pay the upfront cost of migration in t_2 ($s_0 + w_o + \tau > c$). If $s_0 \geq c$, migrating in t_1 is always preferable to migrating in t_2. If $c - w_o - \tau \leq s_0 < c$, a household member migrates in t_2 if:

$$
U^{Case2} > U^{Case3} \Leftrightarrow w_d - w_o > c
$$

A.3 Proof of Proposition 3

The lifetime utilities of financing migration in t_1 (Case 1), financing migration in t_2 (Case 2), or not migrating at all (Case 3) are:

$$U^{Case1} = u(s_0 - c + 2w_d)$$
$$U^{Case2} = u(s_0 - c + w_o + w_d + \tau)$$
$$U^{Case3} = u(s_0 + 2w_o + \tau)$$

Case 1: migration in t_1 Financing migration in t_1 is only feasible if the initial level of savings s_0 is large enough to finance the upfront cost of migration ($s_0 \geq c$). This budget constraint is not affected by the conditional cash transfer. If feasible, a household member migrates in t_1 if:

$$\begin{cases} U^{Case1} > U^{Case2} \Leftrightarrow w_d - w_o > \tau \\ U^{Case1} > U^{Case3} \Leftrightarrow 2(w_d - w_o) > c + \tau \end{cases}$$

If $\tau > c$, then the first condition is more stringent than the second one ($U^{Case2} > U^{Case3}$). If $\tau < c$, then the second condition is more stringent than the first one ($U^{Case2} < U^{Case3}$)

Case 2: migration in t_2 Financing migration in t_2 is only feasible if the household can save enough in t_1 to pay the upfront cost of migration in t_2 ($s_0 + w_o + \tau > c$). If $c - w_o \leq s_0 < c$, migration cannot be financed in t_1. In this case, a household member migrates in t_2 if:

$$U^{Case2} > U^{Case3} \Leftrightarrow w_d - w_o > c$$

If $s_0 \geq c$, migration can be financed in both t_1 and t_2. In this case, a household member migrates in t_2 if:

$$\begin{cases} U^{Case2} \geq U^{Case1} \Leftrightarrow w_d - w_o \leq \tau \\ U^{Case2} > U^{Case3} \Leftrightarrow w_d - w_o > c \end{cases}$$

A.4 Proof of Proposition 4

If $s_0 \geq c$, the household does not need to borrow to finance migration in t_1. Therefore, borrowing only occurs if borrowing is necessary and sufficient to finance migration in t_1, which occurs if $c - B \leq s_0 < c$. If the household borrow, it will borrow the amount $c - s_0$, which is the minimum loan that allows financing migration in t_1. The household will not borrow more as borrowing is costly ($r \geq 0$ and as consumption smoothing is irrelevant following the assumption that households are maximizing lifetime wealth.

The lifetime utilities of financing migration in t_1 with savings (Case 1A), financing migration in t_1 with a loan (Case 1B), financing migration in t_2 (Case 2), or not migrating at all (Case 3) are:

$$\begin{aligned}
U^{Case1A} &= u(s_0 - c + 2w_d) \\
U^{Case1B} &= u(s_0 - c + 2w_d - (c - s_0)r) = \\
U^{Case2} &= u(s_0 - c + w_o + w_d) \\
U^{Case3} &= u(s_0 + 2w_o)
\end{aligned}$$

If borrowing is necessary and sufficient to finance migration in t_1 ($c - B \leq s_0 < c$), borrowing is optimal if:

$$\begin{cases} U^{Case1B} > U^{Case2} \Leftrightarrow w_d - w_o > r(c - s_0) \\ U^{Case1B} > U^{Case3} \Leftrightarrow 2(w_d - w_o) > c + r(c - s_0) \end{cases}$$

A.5 Proof of Proposition 5

Expected utilities The lifetime expected utility of a household attempting to migrate in t_1 is:

$$U^{Case1} = p[u(s_0 - c + 2w_d)] + (1-p)[u(s_0 - c + 2w_o)]$$
$$= u(s_o - c + 2pw_d + 2(1-p)w_o - \pi_1)$$

where π_1 is the risk premium associated with migrating in t_1. The lifetime expected utility of a household attempting to migrate in t_2 is:

$$U^{Case2} = p[u(s_0 - c + w_o + w_d)] + (1-p)[u(s_0 - c + 2w_o)]$$
$$= u(s_o - c + w_o + pw_d + (1-p)w_o - \pi_2)$$

where π_2 is the risk premium associated with migrating in t_2. The lifetime utility of a household who does not finance migration is:

$$U^{Case3} = u(s_0 + 2w_o)$$

Case 1: migration in t_1 Financing migration in t_1 is only feasible if the initial level of savings s_0 is large enough to finance the upfront cost of migration ($s_0 \geq c$). It is straightforward that $U^{Case1} > U^{Case2}$: the probability of success and the bad outcome are the same for these two lotteries, while the good outcome is better in Case 1 (given the assumption $u' > 0$). Therefore, if feasible ($s_0 \geq c$), a household member migrates in t_1 if:

$$U^{Case1} > U^{Case3} \Leftrightarrow 2p(wd - wo) > c + \pi_1$$

Case 2: migration in t_2 Financing migration in t_2 is only feasible if the initial level of savings s_0 and the wage at origin are large enough to finance the upfront cost of migration in t_2 ($s_0 + w_o \geq c$). If $s_0 \geq c$, migration in t_2 is never optimal as $U^{Case1} > U^{Case2}$. If $c - w_o \leq s_0 < c$, a household member migrates in t_2 if:

$$U^{Case2} > U^{Case3} \Leftrightarrow p(wd - wo) > c + \pi_2$$

A.6 Proof of Proposition 6

Expected utilities The lifetime expected utility of a household attempting to migrate at the beginning of t_1 and benefiting from an unconditional cash transfer at the end of t_1 is:

$$\begin{aligned} U^{Case1} &= p[u(s_0 - c + 2w_d + \tau)] + (1-p)[u(s_0 - c + 2w_o + \tau)] \\ &= u(s_o - c + 2pw_d + 2(1-p)w_o + \tau - \pi_1') \end{aligned}$$

where π_1' is the risk premium associated with migrating in t_1. The lifetime expected utility of a household benefiting from an unconditional cash transfer at the end of t_1 and attempting to migrate at the beginning of t_2 is:

$$\begin{aligned} U^{Case2} &= p[u(s_0 - c + w_o + w_d + \tau)] + (1-p)[u(s_0 - c + 2w_o + \tau)] \\ &= u(s_o - c + w_o + pw_d + (1-p)w_o + \tau - \pi_2') \end{aligned}$$

where π_2' is the risk premium associated with migrating in t_2. The lifetime utility of a household benefiting from an unconditional cash transfer at the end of t_1 and not attempting to migrate is:

$$U^{Case3} = u(s_0 + 2w_o + \tau)$$

Case 1: migration in t_1 Financing migration in t_1 is only feasible if the initial level of savings s_0 is large enough to finance the upfront cost of migration ($s_0 \geq c$). It is straightforward that $U^{Case1} > U^{Case2}$: the probability of success and the bad outcome are the same for these two lotteries, while the good outcome is better in Case 1 (given the assumption $u' > 0$). Therefore, if feasible ($s_0 \geq c$), a household member migrates in t_1 if:

$$U^{Case1} > U^{Case3} \Leftrightarrow 2p(wd - wo) > c + \pi_1'$$

Case 2: migration in t_2 Financing migration in t_2 is only feasible if the sum of the initial level of savings s_0, the wage at origin w_o and the cash tranfer τ is large enough to finance the upfront cost of migration in t_2 ($s_0 + w_o + \tau \geq c$). If $s_0 \geq c$, migration in t_2 is never optimal because $U^{Case1} > U^{Case2}$. If $c - w_o - \tau \leq s_0 < c$, a household member migrates in t_2 if:

$$U^{Case2} > U^{Case3} \Leftrightarrow p(wd - wo) > c + \pi_2'$$

The budget constraint in t_2 is eased by the cash transfer (liquidity channel). Furthermore, if the utility function is characterized by decreasing absolute risk aversion (DARA), $\pi_1' < \pi_1$ and $\pi_2' < \pi_2$, implying that households are less risk averse thanks to the transfer and more willing to accept the risk associated with migration. By contrast, if the utility function is characterized by increasing absolute risk aversion (IARA), $\pi_1' > \pi_1$ and $\pi_2' > \pi_2$, implying that households become more risk averse with the cash transfer and less willing to accept the risk of migrating. If the household is risk neutral, $\pi_1' = \pi_1$ and the only effect of the cash transfer is through the liquidity channel.

B Sub-analysis outlined in the PAP

Remittances For each household member who was reported as having migrated to Mayotte between the baseline and follow-up survey, and still in Mayotte at follow-up, we collected data on remittances sent to the household of origin. In Table A8, we present the impact of the program on two main variables: (i) a dummy indicating whether the migrant sent remittances to his or her household of origin (using a 12 months recall period); (ii) the total amount of remittances sent. While the program seem to have had a positive effect on remittances, coefficients are small in absolute terms and non-significant. The latter could be explained by the fact that a minority of migrants started to remit (migration usually takes time to become profitable). Alternatively, it may also be due to a crowding out-effect of the program on remittances, though we should observe a negative coefficient if this mechanism was widespread.

Table A8: Treatment effects on remittances

	Remittances (dummy)			Remittances (amount sent)		
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	0.010	0.008	0.008	0.120*	0.106	0.107
	(0.006)	(0.006)	(0.006)	(0.069)	(0.069)	(0.069)
Extended controls	No	Yes	Yes	No	Yes	Yes
Island FE	No	No	Yes	No	No	Yes
Control mean	0.016	0.016	0.016	0.175	0.175	0.175
Observations	2163	2163	2163	2163	2163	2163

Notes: The dependent variable in columns 1 to 3 is a dummy equal to one if the migrant sent remittances to his or her household of origin. The dependent variable in columns 4 to 6 equals the amount of the remittances. An inverse hyperbolic sine (IHS) transformation has been applied to the amount of the remittances. We do not have information on remittances sent by return migrants during their time in Mayotte. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Migration reasons When respondents reported a migrant, we further inquired about the reason for migrating. The impact of the program by migration reason is presented in Table A9. Respondents declared three main reasons for migrating: economic reasons, health reasons, and family reasons. The overall positive effect on migration we observe seems to be especially driven by individuals migrating for health reasons, followed by family migration, and economic migration. However, Table A10 shows that economic migrants are not the only one to send remittances to their household of origin. People migrating for health and family reasons also remit. This suggests that the different migration reasons are not mutually exclusive, even though our survey instruments inquired respondents to select only one type of migration. In addition, people migrating for economic opportunities might state health or family motives because they believe these motives could be seen as more legitimate.

Table A9: Treatment effects by migration reasons

	Migration (excl. returns)					
	(1) Economic	(2) Health	(3) Family	(4) Studies	(5) Tourism	(6) Other
Treatment	0.007	0.020***	0.011	-0.001	-0.004	-0.001
	(0.007)	(0.007)	(0.007)	(0.004)	(0.003)	(0.002)
Extended controls	Yes	Yes	Yes	Yes	Yes	Yes
Island FE	Yes	Yes	Yes	Yes	Yes	Yes
Control mean	0.023	0.025	0.026	0.007	0.005	0.002
Observations	2163	2163	2163	2163	2163	2163
	Migration (incl. returns)					
	(1) Economic	(2) Health	(3) Family	(4) Studies	(5) Tourism	(6) Other
Treatment	0.002	0.024**	0.022**	-0.002	0.001	-0.001
	(0.009)	(0.010)	(0.008)	(0.004)	(0.003)	(0.002)
Extended controls	Yes	Yes	Yes	Yes	Yes	Yes
Island FE	Yes	Yes	Yes	Yes	Yes	Yes
Control mean	0.040	0.047	0.030	0.008	0.005	0.002
Observations	2163	2163	2163	2163	2163	2163

Notes: Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A10: Summary statistics on remittances sent by migration reason

	Remittances			N
	Dummy	Amount sent		
		(All)	(if D=1)	
Economic	0.44	5.00	11.49	62
Health	0.13	1.24	9.83	79
Family	0.24	2.79	11.49	70
Studies	0.14	0.87	6.10	14
Tourism	0.17	1.92	11.51	6
Other	0.00			4
Total	0.23	2.58	11.16	208

Notes: An inverse hyperbolic sine (IHS) transformation has been applied to all remittances amount. The sample is restricted to Mayotte migrants. We do not have information on remittances sent by return migrants during their time in Mayotte.

Heterogeneous effects Finally, we examine heterogeneity in the effect by baseline characteristics. In Table A11, we analyze whether the effect varies with (i) the willingness to migrate, (ii) the number of rounds of CFW received, (iii) the number of working-age adults in the household, (iv) the total consumption per adult equivalent, and (v) the schooling of the household head. Because of the financial constraints highlighted above, we expect the effect to increase with household willingness to migrate and the number of CFW received, and decrease with consumption. The mediating effect of the number of working age adults is more ambiguous. The more working-age adults in the household, the less binding the labor requirement of CFW opportunities. However, the marginal effect of cash received may be smaller in larger households.

Table A11: Heteregeneous Effects

	Migration (excluding returns)				
	(1)	(2)	(3)	(4)	(5)
Treatment	0.022*	-0.035	0.030	0.040	0.028*
	(0.013)	(0.042)	(0.024)	(0.091)	(0.015)
Treatment x Willing to migrate	0.025				
	(0.033)				
Treatment x CFW rounds (N)		0.013			
		(0.009)			
Treatment x Working age adults (N)			-0.001		
			(0.008)		
Treatment x Consumption				-0.002	
				(0.012)	
Treatment x Schooling					0.000
					(0.013)
Extended controls	Yes	Yes	Yes	Yes	Yes
Island FE	Yes	Yes	Yes	Yes	Yes
Control mean	0.078	0.078	0.078	0.078	0.078
Observations	2181	2181	2181	2181	2181

Notes: Each column refers to a different LPM estimate using equation (19). Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

The sign of the interaction terms are in line with expectations, but not significant at conventional significance levels. It seems that the effect is stronger for households willing to migrate and receiving more CFW rounds, and lower for more wealthy households. The number of working-age adults does not seem to condition the effect. We explored the presence of potential non-linearities using a quadratic interaction term but the results show no effects.

We investigate heterogeneous effects more comprehensively by implementing the endogenous stratification method, a three-step procedure which allows to assess how different groups are affected by the treatment. First, using control households, we regress the outcome variable (migration to Mayotte) on the baseline characteristics highlighted in Table 2. We then use the fitted coefficients to predict migration in the absence of treatment for both the treatment and control groups. Finally, we split the households into different groups on the basis of their predicted migration values and estimate treatment effects across these groups.[32] The results are presented in Table A12.

Table A12: Endogenous stratification

	Household		Individual			
	Migration (excl. returns)	Migration (incl. returns)	Migration (excl. returns)		Migration (incl. returns)	
	(1)	(2)	(3)	(4)	(5)	(6)
Low predicted migration						
Treatment	0.025*	-0.009	0.001	0.006**	0.002	0.005
SE	(0.015)	(0.021)	(0.003)	(0.003)	(0.003)	(0.004)
Control mean	0.018	0.070	0.011	0.007	0.015	0.011
Medium predicted migration						
Treatment	0.016	0.067**		-0.002		0.003
SE	(0.022)	(0.028)		(0.005)		(0.005)
Control mean	0.067	0.090		0.014		0.020
High predicted migration						
Treatment	0.044	0.043	0.011***	0.014***	0.016***	0.018**
SE	(0.032)	(0.036)	(0.004)	(0.005)	(0.005)	(0.006)
Control mean	0.150	0.229	0.019	0.023	0.032	0.040
Number of groups	3	3	2	3	2	3
Predictors:						
Extended controls	Yes	Yes	No	No	No	No
Island FE	Yes	Yes	Yes	Yes	Yes	Yes
Individual controls	No	No	Yes	Yes	Yes	Yes
Observations	2181	2181	14288	14288	14288	14288

Notes: Using the leave-one-out estimation procedure. Standard errors in parentheses are bootstrapped (1,000 repetitions). *** p<0.01, ** p<0.05, * p<0.1.

[32] The fitted model is estimated excluding the observation itself to avoid bias (Abadie et al., 2018). We used the *estrat* Stata command with the leave-one-out option which automates the procedure.